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# Current History

A WORLD AFFAIRS MONTHLY

JULY/AUGUST, 1978

## AMERICA'S ENERGY POLICY TOMORROW

THE ECONOMIC IMPACT OF AMERICAN OIL DEPENDENCY .....	Roy A. Werner	1
THE STRATEGIC-MILITARY IMPORTANCE OF OIL .....	Edward W. Erickson	5
THE NATIONAL ENERGY PROGRAM EVALUATED .....	Walter J. Mead	9
A NATIONAL ENERGY CONSERVATION POLICY .....	John H. Gibbons and William U. Chandler	13
ALTERNATIVES TO THE ENERGY CRISIS .....	Ali B. Cambel	16
NUCLEAR POWER: A BOON OR A MENACE? .....	Henry S. Rowen and Beverly C. Rowen	19
MORE REGULATION NEEDED: AMERICA'S ENERGY POLICY TOMORROW .....	Carter Henderson	23
THE GOVERNMENT'S ROLE IN THE ENERGY CRISIS .....	Fern Racine Gold and Charles K. Ebinger	27
TWO MONTHS IN REVIEW .....		39
GRAPHS • U.S. Energy Resources and Needs, 1950-1990 .....		Inside Back Cover

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# Current History

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*What should be the energy policy of the United States? Can we move successfully toward energy independence? These questions are discussed in this issue, the conclusion of our symposium on energy. As our first article points out, "the net effect of the United States oil dependency . . . will be to enhance OPEC's bargaining status . . . and to serve as a catalyst in reforming international political and economic relations." Meanwhile, "The United States and OPEC are mutual hostages."*

## The Economic Impact of American Oil Dependency

BY ROY A. WERNER

*Legislative Assistant to United States Senator John Glenn*

**F**OUR years ago, the effects of the oil embargo were dramatically evident; there were long lines at every gas station, cold homes and closed factories. Yet, in 1978, when imported oil approaches 50 percent of domestic consumption, roughly half the American people are unaware that the United States must import oil.

The United States is the world's third leading oil producer, behind the Soviet Union and Saudi Arabia. Distribution of petroleum supplies in 1976 required 268 refineries, 223,000 miles of pipeline, more than 25,000 bulk plants and terminals, and about 186,000 gasoline service stations. Oil companies and dealer-operated gasoline stations employ about 1.5 million people, or one of every 62 people in the civilian labor force.<sup>1</sup> More important, post-World War II American society has been built on the assumption of cheap and plentiful energy: suburban homes, automobile transportation, dispersed factories, and convenient but energy inefficient industrial production and agricultural techniques. Thus, oil is a vital and complex component of the United States economy.

The 366 percent increase in world oil prices in 1973-1974, including inflation, balance of payments problems, unemployment, and an uncertain economic future, posed economic challenges to all oil-consuming nations. The fundamental alteration in the international economic system is the high cost of energy. The world energy bill rose from \$20 billion in 1973 to about \$100 billion in 1976. The embargo of 1973-1974 "cost between \$15 billion and \$20 billion in gross national product (GNP) and half a million jobs, and added five percentage points to the consumer price index."<sup>2</sup> It was estimated in 1977 that an oil embargo would cause the loss of between \$39 billion and \$56 billion in GNP and between one and one and one-half million jobs, if it lasted six months.<sup>3</sup> The policy question is thus how higher oil prices will affect future economic growth.

Ultimately, energy policy could collide with the assumption that economic growth will lessen social problems of poverty, unemployment and income distribution. Inflation, aggravated by energy prices, redistributes income in a society to those who hold real assets and reduces the real income of consumers. Future energy policy may sharpen the focus on the "quality of life," but it will also have the effect of reducing hope. This undermining of economic aspirations and prospects of mobility—if it occurs—will change the social fabric of America.

In an economy moving towards an energy-frugal model, the critical question is whether jobs depend on

<sup>1</sup>*Facts About Oil* (Washington, D.C.: American Petroleum Institute, n.d.), pp. 4-5.

<sup>2</sup>*The Economic Impact of the Oil Embargo on the American Economy* (Washington, D.C.: Federal Energy Administration, 1974).

<sup>3</sup>Estimate of Herman T. Franssen, Library of Congress, reported in "U.S. Seen Relying Heavily on Arab Oil," *The Oil and Gas Journal*, January 5, 1976, p. 55.



(1) growth and (2) energy. Obviously, in the near term the answer is yes. But over a longer period it may be possible to substitute more labor intensiveness and alternative supplies for energy and actually to increase jobs. This is certainly possible in the agricultural and service sectors of the economy. However, the sociological problem of status will remain; this could be a source of some tension. But higher oil prices do contribute to inflation. The traditional remedies for inflation are reduced government spending and the slower growth of money supplies, and these remedies induce recessions, thereby curtailing jobs and slowing economic growth. The double-digit inflation of 1974 provides a classic example; the effect of higher oil prices rippled through food chain and distribution networks, plastics and other petrochemical products, creating reduced demand and unemployment.

Although the United States shares these worldwide economic problems, it enjoys a relatively favorable position. Domestic energy production accounts for 79.5 percent of United States energy consumption. Enormous reserves of coal, shale oil and other fossil fuel sources are available. But the dominant issue is where the balance will be struck between prices for oil and for other fuels like natural gas or shale oil.

The availability and the price of energy in the United States respond primarily to the supply and price of oil. Significantly, there are no domestic policy options on either the supply or demand side of the equation that will remove the need to import nearly half of our oil consumption needs during the next decade.

Pricing is the most controversial issue in the oil debate. What price will produce what level of exploration and production? Given the finite resource, at what point is it no longer technologically cost-effective to extract difficult oil? Drilling must go deeper and deeper. Dry holes cost millions of dollars. Secondary and tertiary recovery costs are high. Obviously, some reserves must be bypassed because of costs. Yet, United States policy under both Republican and Democratic administrations has been to keep the price of domestic crude oil below the world price set by the Organization of Petroleum Exporting Countries (OPEC). Various industry officials and economists have deplored this policy and have urged a "free market" approach, citing the need for incentives to expand supply and the efficiency of a nonbureaucratic allocation mechanism. However, the economic disadvantage of sizable cost increases, the larger profits, and the probable political consequences made an unregulated approach unacceptable.

The attempt to find a viable compromise between a free market and total regulation is the crux of the 1978 energy debate. Various tax schemes are proposed to modify the disadvantages of a completely free market

mechanism. Obviously, total government control of oil production is unacceptable, given the possibility that domestic production from depleting reserves would continue while new production might be stifled while producers awaited price hikes. Hence, it is probable that a triple price system (old domestic oil; new or exempted domestic oil; and imported oil) will continue, with attempts to structure further incentives for production and consumption.

This "tinkering" with a tax incentive approach ignores the fact that American citizens are responsive only to specific energy crises—the oil embargo of 1973 or the natural gas crisis of 1976-1977—that affect their jobs and homes. Even the partially oil-induced appearance of double-digit inflation in 1974, blurred by pervasive peacetime inflation, failed noticeably to reduce oil demand. A major difficulty for economists is determining supply elasticities in energy products. But most economists agree that modest price increases will not have a significant impact on either demand or supply. Thus the probable magnitude of future price hikes is unlikely to contribute substantially to easing demand. Instead, it will simply induce conservation, thereby allowing more time for the transition to a less fossil-fuel-oriented economy.

For the immediate future, then, America has an oil- and gas-based economy. The United States oil appetite must be satisfied with imports that increase United States vulnerability and adversely affect the balance of trade. In 1977, United States imports exceeded exports by \$26.6 billion. This trend will continue, until oil imports are significantly reduced. The 1977 balance of payments deficit was \$31.4 billion; the principal difference was the import of oil from the Virgin Islands, a non-customs duty zone. However, these figures hide the heavy OPEC investments in real estate, government securities, stocks, and bank deposits. Because the United States financial markets have required relatively little disclosure of ownership information, it is difficult to track these capital flows. Yet as Treasury Secretary W. Michael Blumenthal said, "we must acknowledge that large OPEC surpluses are not . . . a short-term problem."<sup>4</sup>

A lurking problem is the fact that some nations must bear the deficits that are created by the OPEC surplus. Under these circumstances, the coordination of national economic policies is essential to avoid disruptive trade practices. The combined OPEC nations are basically independent of any specific national policy. But any economic action other than reducing imports will have an effect on non-OPEC countries. Since most nations receive less in capital flows from OPEC countries than their current accounts deficits, the eventual burden of debt repayment is not resolved. The eventual resolution of these debts will have significant impact on national economies.

For example, in 1977, the United States moved into

<sup>4</sup>"Toward International Equilibrium: A Strategy for the Longer Pull," a speech presented to the International Monetary Conference, Tokyo, Japan, on May 25, 1977, p. 2.

**TABLE 1: U.S. PRODUCTION AND CONSUMPTION OF PETROLEUM\***

(thousands of barrels daily)

Year	Production	Consumption	Dependence
			Gap
1945	5,010	5,385	375
1955	7,599	8,861	1,262
1965	9,014	11,303	2,289
1970	11,314	14,350	3,036
1975	10,045	16,335	6,290
1977**	9,841	18,351	8,510

\*Includes crude oil, natural gas liquids and other hydrocarbons.

\*\*Preliminary data only.

Note: Since small quantities are exported and the stocks change, the exact dependence gap does not equal consumption minus production, as shown here.

Source: U.S. Bureau of Mines.

a current accounts deficit of \$10-\$12 billion, after a 1975 surplus of \$11 billion. Yet Germany and Japan enjoy sizable current accounts surpluses. These surpluses, when added to the OPEC oil-related surplus, make the deficits carried by other states all the larger. Further, some OPEC members may even import more than they earn in later stages of development, thereby raising the issue of financing OPEC imports. Only Saudi Arabia, the United Arab Emirates and Kuwait are likely to continue to possess excess funds. Arab oil producers have amassed hundreds of million of dollars in investments. It would be difficult for them to endanger these funds by actions that could threaten frozen assets and curtailed imports and supplies. Over time, it is likely that OPEC and consumer interests will share mutual financial interests.]

Deficits and import quotas could, however, encourage price increases, cutting consumption, and reducing energy waste. Domestic crude prices have risen ten percent annually since 1974, and Americans have responded to higher fuel bills by insulating buildings, buying more fuel-efficient automobiles, and converting to non-oil-fired power plants. Not a single oil-fired boiler has been ordered since late 1975. Still more could be done. A national building code could require increased insulation, thus reducing the energy used for heating and cooling. But conservation alone will not solve the energy problem. More significant, although the national economy has grown by 13 percent since 1973, petroleum demand has increased only 7.1 percent.

Continued utilization of fossil fuel resources will mean that energy projects will consume an increasing amount of the total investment capital available. A noticeable post-World War II trend is the increased use of less efficient forms of energy. Petrochemicals, including nitrogen fertilizers, plastics and detergents, have replaced naturally renewable products like manure, wood and soap. In a capital-short era, continua-

tion of such a development would fundamentally alter the American system. Certainly, the end of the age of cheap and stable prices for oil has ushered in a decade of slow growth and uncertain economic prospects. During the recession of 1973-1975, total gross national product (GNP) was depressed by the decline in aggregate demand. Increased costs for oil imports and the loss of exports to the oil-poor developing countries depressed demand. The United States economy is limping. In 1946, a barrel of Arabian crude cost \$1.46; in 1965, the same barrel cost \$1.80; the January, 1978, price was \$14.61.

## IMPORT DEPENDENCY

The United States is the world's leading importer of petroleum. In 1977, its imports averaged 8.67 million barrels daily, or about 47 percent of United States oil demand. A decade earlier, total imports were only 12 percent of consumption. The reasons for this surge in imports included electrical generation demand, curtailment of natural gas supplies, lags in expected nuclear power growth, and environmental restrictions. Today, despite the "energy crisis," the United States is the only major country in which 1977 petroleum imports exceeded 1973 levels. Traditionally, United States oil imports came from Latin American and Canadian sources. As these supplies dwindled and consumption rose, the United States began to import Eastern Hemisphere oil. In 1973, when import quotas were hampering the substitution of foreign oil, import restrictions were lifted. Today, OPEC producers supply 83.2 percent of the rapidly rising United States oil imports (Arab producers account for 47.4 percent).

This sharp increase in dependence on oil imports underscores the seriousness of the United States energy situation. A major reason for the shortage of petroleum was an accelerated growth in energy consumption, from less than three percent a year in the 1950's to 5.2 percent annually between 1965 and 1973. Much of this growth was met by oil imports. Imported oil was cheap compared to the exploration and extraction costs of domestic oil. Thus, imports increased with little adverse impact on the balance of payments. This reliance on imports stimulated oil demand and obscured any widespread concern about the depletion of oil reserves. In particular, this growth reflected the continuing high demand for electricity, which is generally energy-inefficient. Domestic petroleum production peaked in 1970 and is now steady at 10.6 million barrels daily. However, because United States demand stands at 18.67 million barrels a day, an inevitable "dependence gap" arises. (See Table 1.)

The scope of future dependence is illustrated by the Central Intelligence Agency estimates of OPEC's production capacity in 1985 at between 45 million and 47.5 million barrels daily and non-Communist demand for OPEC oil at between 47 million and 51 million

barrels daily.<sup>5</sup> Increased United States oil imports are projected to reach 12 million to 15 million barrels daily in 1985, up from the current 7.8 million barrels daily of January, 1978. However, because of previous lags in productive capacity and for other economic or political reasons, OPEC might not substantially increase its 1977 production of 30 million barrels daily (the 1977 figure is inexact but production could have exceeded 35 million barrels daily). This potential shortfall exacerbates the enduring economic issues discussed earlier—inflation, recession and possible political disruption. In short, demand may outstrip supply in the early 1980's. Hence, production limits—not embargoes—may be the more subtle and effective oil weapon.]

[Oil imports cost the United States \$45 billion in 1977 as contrasted to a mere \$4.3 billion in 1972. Obviously, this factor contributes heavily to United States balance of payments problems. Cumulative payments for oil imports between 1974 and 1980 will be massive, perhaps totaling \$250 billion to \$300 billion. Current account deficits to OPEC nations between 1974 and 1980 may total \$120 billion to \$150 billion for the United States. Hence, the oil exporting nations will accumulate sizable financial power. By whatever degree OPEC income exceeds local programs and imports, huge amounts will be invested in the consuming nations.]

However, a detailed analysis of dollar flows associated with oil imports would be necessary to obtain an accurate cost. More imports mean greater shipping costs and a larger dollar outflow when foreign-owned tankers are utilized. To the extent that exploration for oil increases and is financed by United States capital, there is an additional outflow of dollars, minus whatever is spent for United States drilling equipment. Further, management fees, dividends, and investments made in the United States, and purchase of United States imports result in an inflow of dollars. For example, the OPEC aggregate current account surplus in 1975 (\$41.1 billion) fell by 43 percent from 1974 (\$72 billion) because of declining revenues from slackened demand and increased imports. Thus, despite the inherent difficulty, the quantity of these various financial flows must be measured to gain an adequate picture.

Continuing high demand by the United States market has been a major factor in keeping OPEC prices high. If the United States had reduced consumption, the OPEC oil surplus (the difference between actual production and maximum production) would have created downward pressures on the world price of oil. Instead, this continuing high demand will mean that oil from new reserves offshore and on the Alaskan North Slope

will limit the growth of the "dependence gap" only while new supplies exceed the speed with which economic growth is raising oil demand. Since 1968, additions to domestic proved reserves have not kept pace with demand growth. In this sense, national security dictates a strategic stockpile. The United States government is now building such a stockpile, designed to reach one billion barrels in 1984. Given projected consumption and continuing vulnerability, this program may be inadequate. When weighed against costs, however, security interests argue for standby oil capabilities, not high priced autarchy.

#### OPEC AS A POLITICAL ENTITY

Contrary to common opinion, OPEC is not a cartel but a monopoly, whose principal actor, Saudi Arabia, adjusts her production to control price and supply. Because the Saudis have no need for additional current income, they have no economic incentive to expand production to meet anticipated shortfalls. Therefore, although other OPEC members may respond to economic lures, the pivotal member will require other incentives. OPEC nations cannot drink oil, but they can leave it in the ground. Those members who do not need cash for economic development can be expected to use their position for political influence. So long as a surplus exists, OPEC will not have total freedom to set prices. But any worldwide economic recovery will create an upsurge in petroleum demand, thereby strengthening OPEC controls. These facts, coupled with American import requirements, mean that the United States is dependent primarily on Saudi Arabia as a residual supplier and influence.

The sole unknown is the size of Iraqi reserves. This radical state has been the most consistent violator of the shut-in-and-save strategy and has generated internal strain in OPEC by increasing its output and allegedly offering selective price cuts. Nevertheless, it is unlikely that any one state (except Saudi Arabia), acting in such a manner, can undermine the market cohesion and position of OPEC. It is not known whether other members will react in the traditional manner—discovery, accusation, compromise, and renewed promises to uphold the common price system—or whether mutual suspicion will prevail.

A healthy global economic system is in the Saudi interest, but Saudi Arabia's focus has been political. The Saudis joined in the 1973 embargo only after congressional approval of a \$2.3-billion military aid package to Israel; the embargo was officially lifted only after

*(Continued on page 35)*

<sup>5</sup>The *International Energy Situation: Outlook to 1985* (Washington, D.C.: Central Intelligence Agency, 1977), pp. 15-16. These estimates are slightly larger than those contained in the *World Energy Outlook* of the Organization for Economic Cooperation and Development.

**Roy Werner** has served as a foreign affairs officer with the Federal Energy Administration and on the staff of the Senate Interior (now Energy) Committee. He is the author of several articles dealing with the international aspects of oil politics.

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*"In our lifetime, or the lifetimes of our children, it is unlikely that it will make economic sense for the United States to be energy independent. The costs would be too high."*

# The Strategic-Military Importance of Oil

BY EDWARD W. ERICKSON

*Professor of Economics and Business, North Carolina State University*

At the beginning of this century, oil became significant to the military when Winston Churchill decided to convert the British Royal Navy from coal to petroleum.\* Until that time, the primary output of the refineries of the world was illuminating oil. Although the navies of the world are currently converting to nuclear power, oil is of much greater military significance today than it was when the young Winston Churchill was First Lord of the Admiralty and the British Royal Navy ruled the seas.

A number of factors contribute to the strategic and tactical hegemony of oil, but these factors are all manifestations of a single set of underlying facts. The modern economic and military powers are energy intensive, and the most pervasive, most flexible, most cost-effective source of energy is oil. And oil is very likely to continue in this role for the balance of this century and well into the next.<sup>1</sup>

The critical factors that define the immediate military significance of oil are:

- The United States is one of the superpowers on which the balance of world power rests.
- The domestic household, commercial, and industrial activity of the United States is fueled in very large part with oil.
- The United States depends for approximately one-half of its oil consumption upon imported supplies.
- Increased United States oil imports have increas-

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\*Some of the material in this article is adapted from columns written by Erickson for the National Public Policy Syndicate.

<sup>1</sup>In addition to conventional sources of domestic and foreign oil there are higher cost unconventional sources of liquid hydrocarbons. One such is shale oil. See *Wall Street Journal*, January 4, 1974, p.1. In addition to U.S. shale oil, other high cost but abundant oil resources include Canadian Athabasca tar sands and the Venezuelan tar-oil belt.


<sup>2</sup>See for example, *Oil and Gas Journal*, April 24, 1978, p. 214. In the last issue of every month, the journal summarizes oil production by country.

<sup>3</sup>For background on origin of the oil-price explosion see *Forbes*, April 15, 1976, pp. 69-85.

ingly originated from potentially unstable Eastern Hemisphere sources of supply.

- West Europe and Japan share a common economic structure and military defense system with the United States.
- Even if the United States were energy self-sufficient, it would be strategically vulnerable because of its intertwined interests with Japan and West Europe.
- Although the strategic components of naval fleets (aircraft carriers, missile submarines) are being converted to nuclear power, much of the rest of the strategic military forces of the United States and its allies (airpower) and *all* their tactical forces are fueled by oil.
- The global interests of the superpowers in the contested areas of the world have so far been advanced, either directly or by proxy combatants, through limited conventional warfare, and limited conventional warfare depends on oil.
- In the absence of severe nuclear proliferation and failures of restraint, conflicts between smaller countries, which may be originally unconnected to rival superpower contentions, will take one form or another of conventional warfare.
- The Soviet Union is the largest oil producer in the world and is essentially energy self-sufficient.<sup>2</sup>
- Although there is dispute concerning the extent of the Soviet oil and gas resource base and the speed with which it can be developed, the Soviet Union may become a major source of energy supply for West Europe.

Because of the vulnerability of the West, and because it was the readiest lever at hand, oil was used as a weapon by the oil-producing Arab states during the Arab-Israeli hostilities of 1973. Although it is a blunt instrument, the use of oil as a weapon has had a number of consequences. First, it accelerated a rise in world oil prices to a new, higher plateau.<sup>3</sup> Second, it encouraged a worldwide intensified search for new oil supplies; thus world oil-producing capacity is both greater and





more diversified than it was in 1973. Third, the price rise associated with the embargo on oil magnified the international transfer of income and wealth from oil-consuming to oil-producing nations. Fourth, the embargo emphasized the strategic importance of the principal oil-producing states and of the Middle East.<sup>3</sup>

Because Saudi Arabia and Iran together account for about half of the producing capacity of OPEC (the Organization of Petroleum Exporting Countries), and because both these states border the Persian (or Arabian) Gulf, the strategic importance of the Middle East is centered in the gulf and radiates outward to include the Indian Ocean, the Horn of Africa, Afghanistan and the eastern Mediterranean.<sup>4</sup> Because Saudi Arabia alone accounts for approximately half of OPEC excess productive capacity, and because Saudi Arabia has the resource base to permit relatively rapid and substantial further additions to oil production capacity, Saudi Arabia is the balance wheel of OPEC price and supply decisions.<sup>5</sup>

The oil embargo has also influenced the potential resolution of the Palestinian-Israeli question. But the uncertainties with respect to this critical question highlight an important aspect of the "oil weapon." Oil is used rather as a response to some other, more sharply focused, international political event (where conventional war is continued to be regarded as international politics by other means) than as a strategic or tactical weapon of first resort. The oil weapon is a deterrent, but the possibility of undesired repercussions deters its use.

In addition to the effects of the embargo, the uncomfortable results<sup>6</sup> of the use of the oil weapon have caused the West to reassess some strategic relationships. Chief among these are: the role of Saudi Arabia in the world oil market; the relationship of increases in United States demand for imported oil to world oil prices and increases in Saudi productive capacity; and whether the Soviet Union will become a substantial net importer of oil in the mid-1980's, or whether the net Soviet energy balance will involve continued oil self-sufficiency and substantial natural gas exports to West Europe.

This latter question—the Soviet connection—has

<sup>3</sup>For background on the Organization of Petroleum Exporting Countries, see *Wall Street Journal*, December 15, 1976, p. 6.

<sup>5</sup>See E. W. Erickson and H. S. Winokur, Jr., "Nations, Companies and Markets: International Oil and Multinational Corporations," C. Walkins and M. Walker, eds., *Oil in the Seventies* (Vancouver: Fraser Institute, 1977), pp. 170-210.

<sup>6</sup>In the United States, the major visible result of the embargo was the creation of gasoline lines. Since the 1960's, U.S. security policy planning has called for a strategic oil storage reserve, but the U.S. is just now beginning to create such a reserve, and its fill-up is already behind revised schedules. See *Wall Street Journal*, July 22, 1977, p. 15.

<sup>7</sup>*Ibid.*, December 20, 1976, pp. 1, 6.

<sup>8</sup>*Ibid.*, March 1, 1976, p. 14.

<sup>9</sup>See Erickson and Winokur, *op. cit.*

<sup>10</sup>*Wall Street Journal*, May 8, 1978, p. 8.

been the subject of a recent CIA (United States Central Intelligence Agency) report. The further development of the Soviet connection will determine whether the Soviet Union is a major contributing factor to a potential mid-1980's upward price explosion in the world oil market, or whether there is a new set of strategic considerations in East-West relationships in Europe. Any significant influence of the Soviet Union on the world energy economy would be a new development.

The world oil market is a giant jigsaw puzzle, and both the broad outline of the puzzle and the shape and size of particular pieces change over time. At the moment, the two most prominent pieces of the puzzle are Saudi Arabia and the United States.

Saudi Arabia is the largest supplier of oil to the world market. The United States is the greatest demander.

In addition to being the largest exporter to the world oil market, within the OPEC pricing framework Saudi Arabia is the supplier of last resort. The Saudis have absorbed the brunt of the swings in world demand and supply, and their price preferences are determined by caution, economics, global diplomacy, internal Saudi politics, and the dynamics of OPEC.

Other OPEC countries would be pleased if the Saudis would hold a substantially higher price umbrella over their heads, step aside to make room for them and allow them to produce as much as they desire.<sup>7</sup> The non-Saudi OPEC countries' production targets would then depend on their own domestic needs.

The demonstrated ability of the expenditures of oil producing nations to adjust upward to higher levels of wealth and income suggests that, in general, these nations are willing to supply as much oil as is demanded at the overall OPEC price. The specific demands on various individual countries depend on their particular prices, taxes and crude oil quality differentials relative to the basic Saudi reference price. The big question is: what price do the Saudis desire?

The Saudis have operated with caution and patience to establish their leadership position. Shortly after OPEC assumed preeminence in world oil markets, the world plunged into an industrial recession (which was only in relatively small part attributable to higher oil prices).<sup>8</sup> World oil demand fell off significantly, and declines in Saudi output took up the largest part of the slack necessary to maintain the OPEC price.<sup>9</sup>

On the other hand, when Oil Minister Amouzegar of Iran subsequently attempted to ram through higher prices, Sheikh Yamani of Saudi Arabia stood fast. The two-tier OPEC price split opened up and the lower priced Saudi oil was in relatively heavy demand. To meet this demand, Saudi output increased by several million barrels per day. Iran was a big loser.

The briefest summary of the OPEC price formation process is that Amouzegar proposes and Yamani disposes.<sup>10</sup> In this light, the pledge to United States President Jimmy Carter by the Shah of Iran to hold the



line on oil prices must be regarded as a simple acknowledgment of the facts of life.<sup>11</sup>

The Saudis can maintain their role only if they have skill and nerve and can hold enough slack in their cash needs and productive capacity to absorb unanticipated swings in output. This, in turn, depends on the relative rates of growth of world demand and non-Saudi supply.

It is in terms of demand that the United States now fits most plainly into the puzzle. During the extremely cold winter of 1976-1977, United States demand for imported oil jumped three million barrels per day.<sup>12</sup> A portion of this increased demand was a response to the American need to overcome regulation-induced shortages of natural gas.

The United States demand for oil imports closes the gap in the United States energy supply and demand balance. If the United States consumes less or produces more domestic energy, oil imports fall. But if the United States demand for oil imports continues to grow at recent rates, we may soon outstrip the Saudi self-interest and ability to exercise price restraint within OPEC.<sup>13</sup>

Any country's calculations of the costs and benefits of alternative policies must start with the OPEC price of oil. A rule of thumb for all oil importing countries is that the minimum cost of additional energy consumption is the world price of oil. Any special national security considerations—like the cost of a strategic stockpile or the risk of making do with an inadequate stockpile—must be added to the price of foreign oil.

The OPEC countries do not give up their oil resources on a charity basis. Although the initial transaction is in financial terms, OPEC countries ultimately are paid in terms of real goods and services.

A country that supplies the United States with a billion dollars worth of imported oil at world prices commands a billion dollars worth of the United States economy. In order to consume imported oil, the United States must ultimately export goods to be consumed in the oil-producing countries. The alternative use for these goods is domestic United States consumption.

United States regulations that use controlled United States crude oil prices to subsidize oil imports transfer wealth and income from the United States to the oil-exporting countries. The reluctance to allow United States energy prices to equalize with world oil prices is a net drain on the American economy and is the bone of

contention at the heart of most United States energy policy controversy.

The reality of the situation is that whatever the OPEC price is, and however it is determined, it is the minimum cost of additional United States energy consumption. If we export soybeans worth the higher world price of oil and consume lower priced gasoline that is subsidized by United States crude oil price controls, we cannot make up the loss on volume.

Other symptoms of economic waste result from the political inability of the United States to face up to the new reality of world oil prices. We are now negotiating contracts with OPEC countries to import liquefied natural gas at prices that are twice as high as the domestic natural gas ceiling prices proposed by President Carter on April 20, 1977.<sup>14</sup>

In our lifetime, or the lifetimes of our children, it is unlikely that it will make economic sense for the United States to be energy independent. The costs would be too high. We are more efficient at producing wheat and computers than we would be at producing the last units of oil and gas and other energy forms that would be required for energy independence. And the social disruption that would result if we were to eliminate imports by reducing our oil consumption by one-half would be intolerable. Instead, it will be advantageous for us to earn energy imports by exporting high technology products like the output of United States agriculture. Nor does it make economic sense to import oil and gas that could be produced domestically at world prices. The regulatory sleight of hand by which we artificially increase United States oil and gas imports is based on continued price controls. And in addition to the economic costs that unnecessarily high United States oil imports create, they also erode our strategic position.

## THE ROLE OF THE SOVIET UNION

The CIA's recent strategic assessment of the world oil market in the mid-1980's focused upon the Soviet Union rather than the United States.<sup>15</sup> Coincidental with President Carter's April 20, 1977, energy message, the CIA study argued that, in the middle 1980's, the Soviet Union would cease to be a modest exporter of oil and gas and would become a net oil importer to the tune of three to four million barrels per day. This forecast led administration spokesmen to talk of 1985 world oil prices of \$35 per barrel (compared to current OPEC prices of \$12 to \$14).<sup>16</sup>

Consider first the question of Soviet potential. The Soviet Union probably has the largest untapped oil and gas potential in the world. Western Siberia is a sedimentary basin five times as large as Texas. Almost half the Soviet Union is underlain by sedimentary structures that fascinate oil geologists. The Soviet Union contains 37 percent of the world's sedimentary areas, compared with 11 percent for the Middle East and 2 percent for North America. Western Siberian cumulative oil

<sup>11</sup>*Ibid.*, November 17, 1974, p. 3.

<sup>12</sup>*Ibid.*, February 25, 1977, p. 22.

<sup>13</sup>*Ibid.*, May 9, 1978, p. 4.

<sup>14</sup>See *ibid.*, August 4, 1977, p. 4 and August 23, 1977, p. 15. See also Executive Office of the President, Energy Policy and Planning, *The National Energy Plan* (Washington, D.C.: Government Printing Office, 1978), pp. 52-55.

<sup>15</sup>Central Intelligence Agency Memorandum ER77-102YOU (McLean, Virginia, April, 1977, publicly available).

<sup>16</sup>*Wall Street Journal*, April 19, 1977, p. 3, and April 22, 1977, p. 1.

production may eventually total 1.4 trillion barrels—or about 200 years of present United States oil consumption—and the geologic resource base for potential Soviet gas production may be even greater.<sup>17</sup>

Potential Soviet oil and gas production, however, will not spring automatically into place. The environment is harsh. Distance is the Soviet difficulty, and the drilling capabilities of the Soviet Union fall far short of United States standards. But as the Soviet Union becomes more integrated into world product and capital markets, a Soviet decision to proceed would be the basis for project financing and practical technical arrangements.

The Soviet Union has strong political and economic reasons not to become an oil importer and it has the resource base to prevent it. If the Soviet Union proceeds to develop its oil and gas potential, it is unlikely that its oil import demand will be the triggering force for another world oil price explosion in the mid-1980's.<sup>18</sup>

If the Soviet oil and gas potential begins to be realized, trade patterns will change. West Europe is apt to become relatively more dependent on Soviet gas and relatively less dependent upon OPEC oil. If West Europe regards OPEC oil as relatively secure and Soviet gas as relatively insecure, while the United States has the opposite perception, the prospect of the increased Soviet natural gas exports to West Europe may seriously affect the balance of secure versus insecure energy sources for the Atlantic alliance.

Moreover, the United States is apt to become a supplier to the Soviet Union of advanced exploration, drilling, production and transportation services, technology and hardware. And we may become dependent, directly or indirectly, on Soviet energy exports.<sup>19</sup> This will change the web of mutual Soviet-United States interdependence and tension.

These potentialities contain both promise and portent. In the last quarter century, the world has grown increasingly interdependent. At the same time, there has been a great deal of violence. Increased mutual interdependence may contribute to relative peace. On the other hand, increased vulnerability and mutual tension may encourage adventurism and aggression.

United States energy policy is central to future developments in the world oil market. If the CIA is correct that a net increase of 3 million-4 million barrels per day of demand in 1985 is apt to cause a new, sharp, upward surge in world oil prices, the United States is more likely to be the source of that demand than is the

Soviet Union because (as a result of price controls on domestic oil and gas production) the United States is the most prominent country in the world that simultaneously discourages domestic energy production and encourages energy consumption. The difference between domestic production and consumption is a net demand for imports. The United States is the largest importer of oil in the world, and our oil imports account for one-fourth to one-third of total OPEC oil output.

There are other aspects of United States energy policy that may increase the economic instability and political jeopardy of world oil markets.

In order to win congressional approval for the environmental legislation that permitted the construction of the Alaskan pipeline, the oil companies involved agreed that Alaskan oil would not be exported. As a result, Alaskan oil must be consumed in the lower 48 states. But there is more Alaskan oil than the West Coast can absorb. Consequently, there are a variety of pipeline proposals to create a route to the American midcontinent; and Alaskan oil is now shipped to our Gulf Coast through the Panama Canal in relatively inefficient tankers small enough to use that facility.<sup>20</sup>

It would make much more sense—economically and strategically—to ship Alaskan oil to Japan in large, efficient tankers and to have Japan compensate the United States by providing Eastern Hemisphere oil to the United States East and Gulf Coasts in exchange. At first this proposal may sound backward. Would not shipment of Alaskan oil to Japan and increased Eastern Hemisphere imports on the United States East and Gulf Coasts increase United States strategic jeopardy to a political embargo or military denial of Eastern Hemisphere supplies?

The consideration of this question requires recognition of the interrelationships among the United States, West Europe and Japan. If strategic storage reserves are finally assured and if international sharing agreements in place among oil-importing countries work, a political embargo is apt to be a minor inconvenience.<sup>21</sup>

A major political embargo involving a concerted and significant reduction in supplies would most likely have to be broadly targeted to be effective. The military denial of substantial supplies would almost necessarily affect the United States, West Europe and Japan as a group.

(Continued on page 38)

<sup>17</sup>These considerations are further developed in E. W. Erickson and H. S. Winokur, Jr., "World Oil and Gas Supply: Whose Crisis?" in Rocky Mountain Petroleum Economics Institute 1977, *Proceedings* (Boulder, Col.: Westview Press, 1978).

<sup>18</sup>*Wall Street Journal*, May 8, 1978, p. 6.

<sup>19</sup>*Ibid.*, January 23, 1976, p. 3; March 12, 1976, p. 1.

<sup>20</sup>*Ibid.*, July 8, 1977, p. 2; July 11, 1977, p. 4; July 15, 1977, p. 1.

<sup>21</sup>*Ibid.*, May 21, 1976, p. 15.

**Edward W. Erickson**, a member of the National Petroleum Council, has been a member of the Brookings Panel on Economic Activity and was a United States delegate to the Economic Commission for Europe Symposium on Mathematic Models of Sectors of the Energy Economy, Alma-Ata, U.S.S.R., in 1973. He is the author of *The Energy Question*: vol. 1, *The World*; vol. 2, *North America* (Toronto: University of Toronto Press, 1974), edited with Leonard Waverman.

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*"An analysis of 11 major federal energy policies of the last half-century indicates a record of conflicting and counterproductive government policies. . . . Unfortunately, there is no evidence to suggest that government behavior in the future will differ from the past. Political incentives are unchanged."*

# The National Energy Program Evaluated

BY WALTER J. MEAD

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**F**OR the last 5 years there has been a uniform cry from concerned businessmen, environmentalists, oil people, and political figures calling for a "comprehensive national energy policy."<sup>\*</sup> National energy policy to date has consisted of a conflicting set of expedient measures, with domestic tax policies having the effect of subsidizing the flow of capital into petroleum production, while at the same time price controls have reduced profitability and tended to cancel out the first set of policies.

Another tax policy has encouraged foreign oil production while import quotas prevented this subsidized production from entering the United States

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<sup>\*</sup>This article is reprinted from "An Economic Appraisal of President Carter's Energy Program" by Walter J. Mead in *Science*, vol. 197, July, 1977, pp. 340-345. ©1977, American Association for the Advancement of Science.

<sup>1</sup>The White House, "Detailed Fact Sheet, The President's Energy Program," April 20, 1977, p. 1.

<sup>2</sup>The scope of this article is limited by the space available. The President's energy plan is comprehensive indeed. This article will consider select policy issues that are of special interest from an economic viewpoint. Two major elements in the plan (the "gas guzzler" tax and the "stand-by gasoline tax") are ignored. The reasons are twofold: (i) neither provision appears to have any significant chance of being enacted, and second, according to a Chase Econometrics analysis, "even if Congress were to pass the gasoline tax, the probability is fairly high that it would never be initiated" (3, p. 17). This conclusion is based on the reasonable assumption that the short-term price elasticity of demand for gasoline is between -0.1 and -0.2. The probability of congressional passage of the "gas guzzler" tax is reduced by strong opposition from organized labor (especially the United Auto Workers). Also, clear consumer resistance is apparent to Congress.

<sup>3</sup>Chase Econometrics, "Forecast of April 27, 1977, Analysis," April, 1977.

<sup>4</sup>M. A. Adelman, "Efficiency of Resource Use in Crude Petroleum," *Journal of Southern Economics*, vol. 31, no. 101 (October, 1964).

<sup>5</sup>E. W. Erickson and R. M. Spann, "The U.S. Petroleum Industry," in E. W. Erickson and L. Waverman, eds., *The Energy Question: An International Failure of Policy*, vol. 2 (Toronto: University of Toronto Press, 1974), p. 7.

market. In the early 1970's, the federal government forced public utilities to abandon coal-fired generators in favor of oil and gas turbines. Five years later the same government was mandating the opposite shift, at enormous social cost.

While a "comprehensive national energy policy" was obviously needed, very few people bothered to spell out in detail what set of policies they considered to be beneficial. Professional economists who specialize in energy research, as well as some spokesmen with a business orientation, had in mind policies that relied on the market forces of supply, demand, and price to allocate scarce energy resources among competing uses. But to political Washington, the cry for a national energy policy is interpreted as a demand for more government decision-making and less reliance on the market. Those who called for a "comprehensive national energy policy" and meant by it greater reliance on market forces must have been shocked when they read principle number one in President Jimmy Carter's energy message. This first principle stated that "we can have an effective and comprehensive energy policy only if the federal government takes responsibility for it. . . ."<sup>1</sup> The essence of the President's energy message implements this first principle. Price controls for both oil and gas are not only extended to cover previously exempt areas, such as intrastate gas, but are also offered as permanent institutions.<sup>2,3</sup>

Professional economists who have specialized in energy economics almost to a man have argued for greater reliance on market forces and less government interference in energy problems. Their strong preference for market solutions is not because they are philosophical conservatives. Rather, they are actually aware of the poor record of government interference in the energy market. That record is one of massive and repeated resource misallocation. M. A. Adelman wrote about "this whole system of organized waste,"<sup>4</sup> while Edward Erickson and Robert Spann described the energy crisis as a "policy induced" crisis.<sup>5</sup>

The record of government intervention on behalf of various interest groups in the energy industry is well known to economists specializing in this area. The past is prologue. Congress, in legislating energy policy, must become aware of its own record.

1) The percentage depletion allowance tax provision affecting oil, gas, and other minerals was introduced more than a half-century ago. One major effect was to increase the flow of capital into oil and gas exploration and production. This in turn increased the supply of petroleum from domestic sources and caused petroleum product prices to be lower than they would have been in the absence of this tax subsidy. This historically low price policy for energy led to both big cars and other evidence of wasteful consumption and to premature depletion of the nation's resources. It contributed to the energy crisis of the 1970's.

2) Tax provisions allowing the expensing of intangible drilling costs for productive wells contributed further to excessive capital flows into oil and gas exploration.

3) A third tax item, the foreign tax credit, stimulated a flow of United States capital into foreign petroleum exploration and therefore rapid production, artificially low prices, and more rapid resource depletion throughout the world. It also led international oil companies to enter other lines of business chartered in low-income-tax countries as a means of using excess foreign tax credits.

4) During the 1930's, in the name of "conservation," the groundwork was laid for production controls ultimately taking the form of market demand prorationing. This is a monopolistic device enforced by government on behalf of the oil industry and was designed to reduce domestic production in order to cause oil prices to rise above competitive levels. This policy therefore tended to cancel out some of the supply effects of the tax subsidies. Market demand prorationing was authorized by two laws passed by Congress, laws authorizing the Interstate Oil Compact and the "Connally Hot Oil Act," which provided the enforcement mechanism.<sup>6</sup>

5) As another monopolistic device, in 1959 the administration of President Dwight D. Eisenhower introduced mandatory oil import quotas having the effect of restricting petroleum supplies from abroad and thereby depleting domestic resources at a faster rate. Quotas were introduced at the insistence of independent crude oil producers, joined by coal producers, and over the opposition of the major international oil com-

panies.<sup>7</sup> Import quotas caused domestic crude oil prices to be about \$1.25 per barrel above the imported crude price until about 1971. The private interest need for import quotas followed from the efforts under market demand prorationing to maintain artificially high oil prices in the United States. Market demand prorationing restrictions on domestic supply designed to increase prices could not work for long without parallel restrictions on imports. At the same time, import restrictions prevented the free flow of imported oil subsidized by the foreign tax credit. This subsidized oil therefore flowed to West Europe and elsewhere, benefiting either foreign consumers in the form of lower prices or foreign governments in the form of higher excise tax receipts at the expense of American taxpayers and consumers.

6) Natural gas price controls originated in a 1938 act of Congress. A Supreme Court decision in 1954 stated that Congress intended price controls to cover the wellhead price of natural gas flowing in interstate commerce. This action, as administered by the Federal Power Commission, continued the historically low price policy for energy. Prices were set below market clearing levels, leading to wasteful consumption and to the severe shortages in early 1977.

7) Price controls over crude oil and products were instituted in 1971 by the administration of President Richard Nixon. To the extent that oil prices are set below market clearing levels, product shortages have resulted. But there is an open-ended oil supply. Declining domestic production from a peak of 10 million barrels per day in 1970, down to about 8.6 million barrels per day currently, paired with increased consumption, is leading to vast increases in imports and consequent dependence and balance of payments problems.

8) With the introduction of multiple-tier pricing as part of price controls, a mechanism was needed to decide who is to be favored with low-priced crude and who must buy the high-priced imports. This led to an allocation program requiring that some firms sell crude oil to others. This is an income redistribution system that also distorts an efficient flow of resources.

9) In addition, the price control system led to politically perceived "inequities" between different refiners and between different parts of the country. Therefore, another offsetting income redistribution system called "entitlements" was established, requiring that money in large amounts (about \$1 billion per year) be passed from one group of refineries to another. Even the President's document admits that the entitlements program is "an administrative nightmare."<sup>8</sup>

10) Early in the present century, a system of four naval petroleum reserves was established. The largest known reserve is Elk Hills in California. During the Arab oil embargo, Congress debated but was unable to authorize a single barrel of oil production from Elk Hills to alleviate the harsh economic effects of that

<sup>6</sup>See S. L. McDonald, *Petroleum Conservation in the United States: An Economic Analysis* (Baltimore: Johns Hopkins University Press, 1971); and W. F. Lovejoy and P. T. Homan, *Economic Aspect of Oil Conservation Regulation* (Baltimore: Johns Hopkins University Press, 1967).

<sup>7</sup>Office of Defense Mobilization, Hearings in the Matter of Petroleum. Washington, D.C., October 22-24, 1956.

<sup>8</sup>Executive Office of the President, *The National Energy Plan* (Washington, D.C.: Government Printing Office, April 29, 1977).



embargo. Now that there is an apparent glut of oil developing on the West Coast, with the introduction of North Slope crude into this market, Congress has legislated production scheduled to expand to 350,000 barrels per day, thereby contributing to the West Coast oil glut.

11) In the 1920's, Congress passed the Jones Act, requiring that all marine shipments between two United States ports be on tankers (i) built in the United States, (ii) owned by American companies, and (iii) manned by American crews. This act has created a domestic monopoly position for each of the three interest groups covered. It now requires that consumers bear the added cost of Jones Act shipping for Alaskan crude oil. The 94th Congress passed the tanker bill that would extend Jones Act conditions to 30 percent of the oil imported into the United States from abroad. This was done at a time when surplus tankers were tied up all over the world. Compliance with the tanker bill would have required massive tanker construction in the United States, thereby contributing to the tanker surplus. It would also have imposed a burden on American consumers estimated at about \$2 billion per year. Except for a presidential veto, the tanker bill would be the law of the land.

Subsequently, the maritime unions, joined by the shipbuilding industry and domestic shipping firms, pressed the 95th Congress to pass a new oil transport bill for a President who had agreed in advance to sign any such legislation. To its credit, the 95th Congress refused to repeat its performance of two years earlier.

Perhaps the foregoing 11 items are sufficient to illustrate why energy economists have not been enthusiastic about additional governmental intervention in the energy market. This record does not lead one to be confident that the public interest will be served by additional government intervention.

This record should surprise no one. Congress and the administration must respond to dominant organized pressures. The President's first principle, suggesting that an effective and comprehensive energy policy requires that the government take responsibility for it, implies that government intervention in the future will wisely serve the general welfare, in contrast to the historical record.

#### **COMMENDABLE FEATURES IN THE ENERGY PROGRAM**

The President's energy message contains several admirable statements and recommendations, from an economic efficiency point of view.

Allocation efficiency will be improved by the President's proposal to let the price paid by users of crude oil rise to the world price. However, this is only half of the market solution, which would allow both the demand price and the supply price to be set by the market rather than by the government.

A presidential directive requiring federal agencies to purchase cars that exceed the average fuel economy by 2 percent in 1978 and 4 percent in 1980 appears to be commendable.

Some of the reforms of public utility rate regulation will lead to greater economic efficiency in that regulated industry. First, peak-load pricing is long overdue. If implemented, it should shift power usage from normal peak-load periods and thereby reduce the need for new construction. Second, the President's proposal to phase out promotional rates and declining rates that are not justified by declining costs will contribute to greater efficiency. Third, the President's proposed prohibition on master metering for electricity in new multiple family or business structures will lead renters to economize on power usage. The present system of master meters in such structures leads renters to treat electric power as a free good and hence to use it excessively.

However, while these public utility measures are commendable, it does not follow that they should be introduced by the federal government. They are within the jurisdiction of state public utility commissions and should be instituted by those agencies.

The President notes that oil and gas are now priced "below their marginal replacement cost and, as a result, the nation uses them wastefully with little regard to their true value." This is a true statement and one might take encouragement from the fact that it is enunciated by the President. However, in the next paragraph of his message he states that "the residential sector is sheltered as the plan would keep natural gas prices to residential users down and provide tax rebates for home oil use." It is clear that his policy recommendations perpetuate the very problem that he has so well identified.

The President's proposal seeking legislation to limit production from the Elk Hills Naval Petroleum Reserve to a ready-reserve level until the West-to-East transportation systems for moving Alaskan oil surplus are in place, and until California refiners have completed a major refinery retrofit program to enable more Alaskan oil to be used in California, is commendable. The proposal could be improved by eliminating its temporary character and placing the Elk Hills Reserve in a permanent, fully developed standby reserve position.

The exemption of shale oil from the President's proposed price control system will enable oil production from our vast shale oil reserves to proceed whenever cost and market conditions justify such production.

The President's proposal to expand the strategic petroleum reserve to the point where the nation could withstand a 10-month supply interruption appears to be desirable. With this reserve, the nation could accept a relatively high level of imports from the Middle East. While this policy will involve balance of payments problems, it is at least consistent with the fact of life

that the large remaining known reserves of crude oil are in the Middle East and not in the United States. It enables us, with reduced risk, to delay developing major supplies of very high cost energy sources as alternatives to imported crude oil.

After observing that the present gasoline price control system is inoperative (prices are determined by competitive conditions), the President wisely recommends gasoline price decontrol.

### QUESTIONABLE PROPOSALS

In addition to these recommendations, which appear to offer greater resource allocation efficiency, there are other recommendations that might possibly be worthwhile on efficiency grounds. The plan calls for many programs that suffer from a common fault—they are not supported by evidence showing that their social benefits exceed their social costs. These programs include the following:

1) New cash subsidies for individuals, home owners, schools, and hospitals to finance weatherization and the installation of miscellaneous "approved conservation measures."

2) New tax subsidies to business to encourage installation of "qualifying solar equipment," "approved conservation measures," and "co-generation equipment."

3) Federal investments in van pooling (6,000 vans to be purchased) for use by federal employees in commuting to and from their jobs. The fact that large-scale unsubsidized van-pooling arrangements have not been successful leads to the suspicion that the self-supporting feature of this proposal will not materialize.

4) In the event that voluntary programs fail to achieve prescribed results, mandatory measures are proposed relative to weatherization, efficiency standards in new buildings, and home appliance efficiency standards.

The economic problem in all these proposals is that subsidies and government force will likely cause scarce resources to be allocated to uses that have a low or negative rate of return to society, unless net external benefits are present. External benefits accrue to society at large, rather than to the individual or business decision-maker. There is no showing of net external benefits in the President's analysis. Where either subsidies or force lead to resource misallocation, the standard of living of the people will be unnecessarily low. Before Congress enacts any of these measures, it should require evidence that the discounted present value of the benefits exceeds the costs.

One of these measures may be used to illustrate the problem. As a force measure, Congress is considering legislation that would prohibit the sale or refinancing of any home not meeting prescribed federal insulation standards. A decision to insulate a home should be based on the present costs of insulation and the flow of

future savings. If costs exceed benefits, such investments should not be made. An exception occurs if there are net external benefits. None are obviously present. If this calculation is distorted by artificially low prices for gas or other energy input, then the obvious correction should be to eliminate the source of the distortion—the current price control system. The President's program perpetuates this problem by extending natural gas price controls and making both gas and oil price controls permanent.

Costs and benefits will differ widely by geographical area, age of the house, difficulty of retrofitting, temperature preferences of individuals, and the like. In the absence of net external benefits, home insulation decisions should be made by home owners, not by a distant Congress.

### COUNTERPRODUCTIVE PROPOSALS

The President proposes two extensions of existing tax subsidies.

1) According to the President's plan, some independent oil and gas producers have been deprived of a portion of the tax reduction enacted in 1976 for the expensing of intangible drilling costs. As a solution to this problem, he proposes that the intangible drilling cost expenditure provision be liberalized. However, further liberalization of tax subsidies will make oil production more profitable after taxes. This is in conflict with the President's own price control measures, which are designed to restrain profitability. Further, a tax subsidy, unsupported by evidence of net external benefits, leads to overinvestment in the subsidized industry and to resource misallocation. Instead of further liberalization, Congress should consider eliminating existing legislation which permits expensing of intangible drilling costs for productive wells and requiring instead capitalization of such expenditures. This provision, of course, should be applicable to all oil and gas producers equally.

The 1975 tax legislation eliminated the percentage depletion allowance completely for large integrated oil companies, but retained it with reduced benefits for small producers. This differential treatment in favor of small producers has no economic justification.

2) In addition, the President proposes that expensing of intangible drilling costs as a tax stimulant be made available to geothermal energy production. The reasoning above applies here also. Further, a tax

*(Continued on page 31)*

**Walter J. Mead** served as senior economist for the Ford Foundation Energy Policy Project in 1972-1973. He has testified before congressional committees concerned with energy legislation on many occasions. Currently, he is on the editorial board of three professional journals and has published articles and books on natural resource economics.

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*"The economy can double its present size by the year 2010 while energy use in that year can be held to a level no higher than today's."*

# A National Energy Conservation Policy

BY JOHN H. GIBBONS

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AND WILLIAM U. CHANDLER

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**E**NERGY conservation became necessary during the oil embargo of 1973-74 because of shortages and sharply rising prices; consequently, most people have come to associate energy conservation almost exclusively with curtailment. In contrast to curtailment (heroic measures to reduce consumption quickly by whatever means are least costly), conservation is the economic response to total energy cost. It means changing technology and procedures to reduce the demand for energy (or for specific scarce fuels) without corresponding reductions in living standards. Conservation can be regarded as a means of enhancing our economic welfare, leaving society materially better off. Thus, conservation is an act of enlightened self-interest.

When the price of energy was much lower, uses that are now economically wasteful were economically rational. The manufacture and use of automobiles that provide only 10 miles per gallon is a good example. Waste, in this sense, is not a vice in and of itself; it is an economic term. Some may object that unless the costs of energy are carefully and broadly defined, this definition of waste does not properly take into consideration the external costs of energy use (e.g., air pollution from automobiles). This objection is appropriate. The failure to internalize all the costs of energy production and consumption has created many of our most serious environmental problems and social inequities. Legislation like the Federal Clean Air and Water Acts, the Coal Surface Mining Control and Reclamation Act, and the Federal Mine Health and Safety Act has now brought us closer to internalizing the cost of energy use, as well as the use of most goods and services.

The implementation of a comprehensive National Energy Policy must incorporate total social costs of energy. Attention must also be paid to fuel switching (as a means of conserving scarce fuel or avoiding the use of particularly obnoxious fuel forms) which, with con-

servation and curtailment, completes the list of the means of reducing energy use.

The implementation of an energy conservation policy has been hampered by the following misconceptions regarding the meaning and practice of conservation:

- Energy and the production of goods and services are intimately and inextricably linked; energy is a relatively fixed factor in the gross national product.
- Energy consumption and jobs are inextricably tied together. More energy consumption means more jobs and vice versa.
- Higher illumination levels generally help productivity; low illumination is injurious to the eyes.
- Reducing the growth of energy consumption implies the replacement of machines (e.g., bulldozers) with manual labor (e.g., men and women wielding picks and shovels to build interstate highways).
- Turning down the thermostat at night is counter-productive—the energy used in heating up the house in the morning more than offsets any savings.

Recent energy conservation research dispels these misconceptions and aids in understanding the potential of conservation over the next 30 years or so.

There are basically two types of responses to energy price increases and other indications of increasing scarcity: behavioral changes, and changes in existing as well as new energy-consuming equipment.

Behavioral changes include many of the actions we take under emergency conditions, like curtailing the use of automobiles, using energy-consuming equipment less, taking shorter showers, and so forth. These are short-term changes that can be made quickly and at little or no cost. Other changes, like lowering thermostat settings, are important and yield benefits in health and comfort (many buildings are not only overlighted but also overheated in winter and overcooled in summer).

Over the mid- and long term, modifications in energy-consuming equipment can yield substantial savings in energy and money, because energy use in the United States is far from efficient. The inefficiency of a

typical gas-heated home is an excellent example. In combustion as much as 25 percent of the energy in the gas goes uselessly up the stack. The pilot light can consume 10 percent of the gas used in a home. Losses through poorly insulated heating ducts can amount to 40 percent. Altogether, from 35 to 55 percent of the useful energy in the natural gas can be wasted in a typical gas furnace system. The situation is similar in homes heated by oil and electricity. In addition to the inefficiency of delivery of heat into the residence, there are two other major sources of loss. First, the thermal shell of the residence is often very transparent to heat and cold, and thus loses energy. Second, the "availability" of heat from these furnaces (typically more than 1,000°F) is inherently vastly greater than required—thereby incurring further losses.

The possibility for conservation in industry can amaze even the proponents of conservation. A recent *Wall Street Journal*<sup>1</sup> article reported the following vignettes of energy savings investments in industry:

- One company invested \$30,000 in boiler controls: savings from this investment equal \$60,000 per year, a 200 percent annual rate of return.
- A tire manufacturer spent \$40,000 to insulate steam valves: savings amount to \$80,000 per year, another 200 percent per year rate of return.
- General Electric invested \$13,000 at one of its plants to shut down certain equipment automatically: annual savings are \$51,000.

These are easy and obvious efforts; however, the number of conservation actions are apparently very large.

Incorporation of energy efficiency into new energy consuming products, like new houses, can yield very large benefits. In fact, careful design and construction can do more than conserve energy. Double-paned glass, thicker insulation, and other energy conserving investments in buildings may decrease the total investment in the structure, for example, by decreasing the size of the air conditioner or furnace that must be provided. Due to this offsetting effect, large improvements in energy efficiency can be obtained with small net changes in total investment.

A prudent consumer would measure the benefit of his expenditure on various energy-saving options and decide which would yield the highest value to him. Educational programs modeled after the highly successful Agricultural Extension Service to give the consumer helpful information about intelligent investments in energy-intensive products are being tested in 10 states.

Industry can respond to increasing energy prices in a variety of ways; thus industrial response requires

detailed examination. Aluminum production, for example, can be reduced in energy intensity by nearly 40 percent, while chemical production may be able to manage only a 20 percent reduction. Uranium enrichment, the process by which nuclear reactor fuel and weapons material for the military is made and which consumes 4 percent of all the electric power in the United States, can be reduced in energy intensity by 90 percent. These improvements can come only over a time span corresponding to the replacement of existing production plants, and as a response to increases in energy prices.<sup>2</sup>

Another example that highlights the potential for conservation in new equipment and illustrates the problem of achieving such savings is what we may call "the paradox of the automobile." To increase gas mileage while retaining a certain amenity level, that is, interior space, safety, and other essential features, we must pay the price of adding improved design and high-technology features like micro-processors (mini-computers) for fuel combustion control and more expensive but lighter-weight materials, like aluminum, or other innovations. Thus, there is a trade-off between fuel and non-fuel costs. The dilemma consists of choosing the right point between the two extremes of fuel and non-fuel costs. The total cost of owning and operating an automobile (the sum of fuel and non-fuel costs) is remarkably insensitive to fuel economy over the broad range of performance from 15 miles to nearly 35 miles per gallon. In other words, it makes little economic difference to the buyer to choose a 35-mile-per-gallon car instead of a 15-mile-per-gallon car. But one can argue that it is in the national interest to choose the more efficient car and to build a more sophisticated domestic car. Though not in the purest sense a paradox, it is puzzling that a choice so profoundly important on the social level is of such little consequence on the individual level. Clearly, the market process does not enable consumers to discern the most efficient choice in terms of merged national and individual self-interest.

Are there many such market distortions? In energy, the answer unfortunately is yes. In the past, the government instituted many regulations and incentives that still provide major subsidies to energy production and use in the United States economy. These include natural gas price controls, tax incentives, and loan subsidies for energy production. New federal regulations and incentives and federal oil policy can alter this situation. For example, Congress has mandated minimum automobile average gas mileage (under the Energy Policy and Conservation Act of 1975, 1985 cars must obtain an average of 27 miles per gallon). Tax rebates and low cost loans can be provided for homeowners who insulate their homes. New construction standards for improved energy efficiency are being promulgated. But perhaps more important, subsidies, like the subsidies for the transport of foreign oil to the United States, should be

<sup>1</sup> *The Wall Street Journal*, February 9, 1978.

<sup>2</sup> J. H. Gibbons et al., "U.S. Energy Demand: Some Low Energy Futures" *Science* 200, vol. 142 (1978). These estimates are based on the assumption that real energy prices will double by the year 2010.



stripped away from general tax revenue. Only when all the costs of energy production are included in the price of energy (that is, internalized) will price signals indicate the need to induce high energy efficiency utilization.

### IMPLICATIONS FOR ECONOMIC GROWTH, EMPLOYMENT, AND TECHNOLOGY

One way to try to understand the impact energy conservation may have on the critical national issues of economic growth, employment, and the future of technology is through the "scenario." Scenario analysis has been widely used to assess the impacts of certain policy choices on our energy future. One such effort<sup>3</sup> constructed a series of scenarios of different energy use levels in the United States to the year 2010, using a combination of econometric and engineering analysis techniques. In one low-energy growth scenario, total energy consumption in the United States is projected to be about 30 percent higher in 2010 than it is now. This glimpse of an imaginary but plausible future assumes that:

- Real income doubles by 2010, a growth significantly lower than obtained in 1950-1975.
- Real energy prices steadily increase and double by the year 2010, corresponding to an average 2 percent increase per year. State and federal policy strongly supports actions to increase the efficiency of energy use.
- Population increases by about one-third (Bureau of Census Series II projections).

Results of the analysis indicate that an economically rational response to these conditions could result in the following possibilities:

- Energy use in buildings could decline at an annual rate of .6 percent, compared to an annual rate of increase of 3 percent currently (in part due to tough building codes and appliance efficiency standards).
- Electricity could account for 30 to 50 percent of U.S. energy consumption in 2010, as compared with 28 percent today, depending on policy actions and the relative prices of other forms of energy.
- Natural gas could supply 11 percent of total demand, compared with 24 percent now.
- Auto efficiency doubles, in part due to regulations.
- Energy consumed per unit output of industry in 2010 is 35 percent lower than in 1975.

In other words, energy utilization efficiencies are made possible by the intelligent response of advanced technology to high and rising energy prices.

Perhaps the single most important conclusion of this study is the statement that the economic well-being of the United States can be maintained while energy growth is diminished. In this projection, gross national product grows at a long-term average annual real rate of about 2 percent (higher in the near term and lower in the long term). This rate reflects the expected slowdown in the growth of the labor force, because of the

decreasing birth rate, and the continued long-term shift in the economy to service-oriented activity. If GNP grows faster, then more energy will be required (e.g., an average 3 percent annual GNP growth will require about 35 percent more energy than an average 2 percent annual growth).

As for employment, the study indicated no major difference in the demand for workers between the lowest and the highest energy demand projection considered.<sup>4</sup> Moreover, energy conservation does not imply the substitution of manual labor for energy, since 20 cents worth of energy will buy the equivalent of a day's work of one laborer at a wheelbarrow. It therefore does not seem likely that we will opt for a return to wheelbarrows, picks and shovels! Instead, highly technical skills, those of electronics technicians, skilled construction workers, engineers, and others who can provide ingenuity in place of the brute force consumption of energy and other resources, will be required.

Consideration of a national energy conservation policy begins with a definition of conservation, including three kinds of conservation: curtailment, fuel switching, and what we call conservation itself. Curtailment involves heroic measures to reduce energy consumption quickly by the cheapest means available. Fuel switching is a method of conserving specific fuels and can be an important complement of conservation. Conservation is the term we reserve for the policy of substituting new technology or different procedures for energy without reducing the amenities we enjoy. Conservation in this sense—an economic sense—is a means of leaving society better off than it would be without it, and is thus an act of enlightened self-interest.

Changing our energy-using behavior can be accomplished much more quickly than can the substitution of new and more efficient energy-consuming equipment. Lowering thermostat settings is a behavioral change that can yield large savings. With the exception of modifications or retrofits to existing property, the replacement of a more energy-efficient house or car must await the end of the useful life of the house or car. The rate of capital equipment turnover, therefore, controls to a large extent the rate at which conservation can be implemented. As a means of dealing with near-term shortages, policymakers can focus on behavioral changes or curtailments, but they must view the retrofit-

*(Continued on page 34)*

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<sup>3</sup>*Op. cit.*

<sup>4</sup>*Op. cit.*

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*"Clearly, alternate energy forms, promising as they are, raise many technical and social questions. We should face these questions now because our nonrenewable resources are running out, and we must have technically reliable and socially acceptable substitutes when the real energy crisis arrives."*

## Alternatives to the Energy Crisis

BY ALI B. CAMBEL

*Professor of Engineering and Applied Science, George Washington University*

**L**IKE shelter, food, clean air and water, benign forms of energy are a necessity of life. Without ample energy we could not heat ourselves in the cold of winter nor cool ourselves in the heat of summer. Without energy, we could not cook food nor refrigerate it for storage. Without energy, our industry and commerce would come to a grinding halt. There would be no transportation and no communications, and all aspects of the life we are used to would come to a standstill. Without energy, civilization, as we know it would cease to exist.

All of this is true for both the developed and the less developed nations. However, there are differences. The developed nations utilize a prodigious amount of energy, compared to the less developed nations. For example, the United States, with approximately 5 percent of the world's population, uses about 30 percent of the world's energy. The main difference between the developed and the less developed countries is that the former are highly capital intensive and rely primarily on inanimate energy, whereas the latter use less capital intensive means and more animate sources of energy.

Another interesting comparison among nations is the relation between the per capita gross national income and per capita energy consumption. In general, there is a close correlation between these two ratios. Thus, in the richer countries, i.e., those with a high per capita gross national product, the energy consumption per person is also high. However, this correlation is not linear. For example, Sweden and West Germany, which enjoy about the same per capita GNP as the United States, use far less energy per person. Although this can be attributed partly to shorter travel distances, it is in great measure due to life-styles, equipment and industrial processes that encourage energy conservation.

In his book *The Last Judgement*, J.B.S. Haldane has a Venusian announcer say, "It was characteristic of dwellers on Earth that they never looked ahead more than a million years, and the amount of energy was ridiculously squandered." Haldane was philosophically

right; until very recently we did not look ahead, and we have and are squandering precious energy. However, we need never run out of energy if we use it judiciously and if we resort to alternate energy forms.

We are not running out of all forms of energy. We are running out of certain forms, e.g., petroleum, which will force us to change our life-styles and adapt to alternate sources of energy. But this is not something new. Man has changed energy forms before. In each case, the change of energy source has meant a change in life-style, but as a rule the new life-style has been preferable to the previous one. There is no reason to believe that our quality of life in the future will not improve. We should look forward with optimistic anticipation rather than with dread and fear. One thing should be clear however: we must resort to alternate energy sources, and we must change our life-style.

Recent historical data of energy consumption in the United States proves this contention. Thus in 1850, 91 percent of our energy consumption was fuelwood, and the remainder was coal. People had to fell trees, chop and split them, and carry them into their storage sheds. The rich could purchase these services, but the common people did it themselves. Clearly, this was a burden that required hearty souls. The wood stove or furnace had to be regularly attended. By about 1910, coal was supplying 76.8 percent of our energy consumption. Coal burning did not have the aroma of wood, but it was more convenient because it was mined and delivered to one's home. With the advent of the so-called Iron Fireman, a furnace could be stoked and left unattended for hours.

In 1960, fuel oil superseded coal. It was regularly delivered to the fuel tank of one's home and required practically no attendance as long as fuel oil suppliers kept the fuel tank full. This meant that householders could go away on weekends or take a vacation without fear that water pipes would freeze. More recently, gas and electricity have taken over. One no longer has to contend with a tank of fuel oil. One merely sets the

thermostat and walks out of the house. Both gas and electricity are also cleaner. A house is uniformly heated, and there is no longer the inconvenience of fuel deliveries.

But with these conveniences go certain difficulties. The centralized mode of energy distribution that created all the aforementioned conveniences also means a heavy dependence on gas or electric utility companies. If there is a blackout, the individual home owner is helpless. If fuel prices go up, so do utility payments. So while centralization has its advantages, it also brings with it a dependence on foreign powers that supply petroleum or on coal miners.

In extricating ourselves from the energy crisis, a two-prong approach is desirable. The first is energy conservation and the second is to develop new supplies of the renewable form of energy like solar energy.

Our energy supply can be increased by increasing our supply of nonrenewable resources and by developing renewable energy sources. We should follow both alternatives; the first for an interim period and the latter for the long haul.

In increasing the energy supply from nonrenewable resources one can develop enhanced recovery from existing oil wells. Various methods have been proposed, like steam and detergents, to dislodge the oil trapped in the geological formations. Another approach is to develop offshore oil reservoirs. Still another is to exploit oil from shale rock or tar sands. All of these methods are being tried, but two nagging questions remain: first, will the cost be reasonable? and second, will the net energy (the ratio of energy extracted to the energy utilized for extraction) be positive?

Although this article is not concerned with conventional uses of fossil energy, one application to coal should be mentioned, namely, Magnetohydrodynamics, commonly abbreviated as MHD. In MHD, coal is pulverized and preheated and then sent through the poles of a magnet. An electric current is produced as the electrically conducting medium passes in between the poles of the magnet. Because MHD does not rely on rotating parts, the mechanical stresses are minimal. Hence, higher temperatures can be used, resulting in higher efficiencies and, thus, less fuel input, which is certainly an indication of conservation and which, if successful, would prolong the availability of coal (which is also a depleting nonrenewable energy resource).

Probably the most promising approach to increasing energy supply is to resort to renewable energy sources. Several methods are promising.

## **SOLAR ENERGY**

The most frequently discussed is solar energy. The solar energy falling on about 2 percent of the land area of the United States could produce all the energy we use.

Solar energy may be utilized in various ways. A solar collector may be installed on a roof or on the side

of a building. A solar collector is a simple device, consisting of a set of pipes mounted on a backboard and protected by a transparent cover. A fluid passes through the pipes and is heated by the sun's rays. In warm climates, water may be used as the working fluid, while in cold climates antifreeze would be necessary. The warm fluid is pumped into the house where it may be used to heat hot water, for example. The warm water may be used for washing, cooking or heating a swimming pool. Solar hot water heating can also be used to advantage by apartment complexes, public institutions (like schools), office buildings and processing plants. Solar units are commercially available. Although the initial cost of a unit is higher than a regular hot water heater, it saves enough gas or electricity to make its operating cost less. Thus, on a life-cycle costing basis, solar units are competitive.

Of course, one must make provision for sunless days, either by using a heat storage facility like an insulated water tank or by establishing a connection to a utility company to provide gas or electricity to heat the water to its proper temperature. This creates an important institutional problem. A consumer uses the utility only when he needs it. This makes it difficult for utilities to plan proper load management. That the problem can be worked out has been demonstrated in a housing development in El Toro, California, in which the Southern California Gas Company plays a major part.

Another form of solar energy also uses collectors and is used for the solar heating and cooling of homes and other buildings. The system is so arranged that the solar energy is used to heat and cool the building. Solar heating is probably more advanced than solar cooling, which uses an absorption type air conditioner. There are numerous houses and a number of school and public office buildings that use this system. Again, these need not be in sunbelt states, although admittedly they would be easier there. For example, there are solar-heated schools in Minneapolis and Boston, and there is a solar-heated federal building in Saginaw, Michigan. The amount of insulation influences design; nonetheless, solar hot water heating, space heating and cooling can be used in the sunbelt and in the frostbelt states.

Another form of on-site solar energy is biomass or fuelwood burning, effective only where there is a net surplus of fuelwood. Advances in wood furnace and wood stove design are in active process. The number of stoves purchased annually in recent years is rising. A modest research effort has begun in this country to design more efficient and automated woodburning stoves and furnaces. Woodburning should be considered in several ways: (a) as supplying all heat requirements of the home including cooking; (b) as providing only space heat to the house; and (c) as providing localized space heating. Thus, a hybrid central system with auxiliary woodburning stoves can reduce the consumption of nonrenewable resources.

There are two other possibilities for on-site solar energy, both of which produce electrical rather than thermal energy: wind electric generation and photovoltaics.

Like fuelwood burning, wind energy conversion is an old technology and may be traced back to the tenth century in Iran. Of course, in those days the energy was used to pump water and to perform mechanical tasks, like grinding foodstuffs. Today the promise of wind energy conversion lies in the generation of electricity for individual buildings and for irrigation on farms, where it can replace electrically driven pumps. The first major wind electric generator was installed in Vermont in 1941 and generated 1,250 kW<sub>e</sub>. This is the well-known Grandpa's Knob installation and was tied into the electric grid. It failed in 1945. Today, there are large-scale experimental wind electric generators as well as small units constructed for homes and farms.

Generally, small wind generators produce direct current (D.C.) whereas we generally use alternating current (A.C.). However, not all appliances require A.C. Thus, the wind electric generator owner has two options. He or she may use an inverter to convert all electricity generated into A.C. or install dual lines for D.C. and A.C., using only a small inverter. Electric lighting can operate on either A.C. or D.C., whereas electric typewriters and stereophonic equipment require A.C. Another alternative is to install an alternator instead of a D.C. generator. Of course, there are times when the wind does not blow. At such times, one can install a battery storage system or hook up to the electric utility grid. One may also install an auxiliary oil-burning engine-generator, many of which are commercially available. For a flexible and reliable system one should have all these standby arrangements.

A very promising source of on-site solar energy is photovoltaics. Although its science is complicated, most people have used it in measuring the light intensity when they take a photograph. In most simple terms, the photons strike a photosensitive element, which converts the solar radiation to electricity. Photovoltaics has been used to advantage in space explorations. It is being used to electrify navigational buoys and railroad crossing signals.

Photovoltaic cells can be produced from a variety of substances but silicon and cadmium sulfide are probably the most promising. Although photovoltaics is a proven technology, it suffers from a high cost per installed kilowatt. However, there is intense research in progress to reduce the cost to 30-50 cents per kilowatt. If this can be achieved, one could cover the roof of one's house with photovoltaic cells instead of with asphalt shingles and derive the electricity needed for the edifice. The current would be D.C.; thus, surplus energy could be stored in batteries. This would have to be converted to A.C. by means of an inverter. If properly synchronized, this could be sold back to the local electric utility.

Solar energy can also be used in centralized form. Solar Power Towers can be built using an array of numerous reflectors focused on an inverted concave mirror which in turn is focused on a steam boiler. The steam generated in the boiler is used to rotate a steam turbine, which, in turn, turns over an electric generator. The centrally produced electricity is then transmitted to load centers and distributed to local users. Such a plant is being planned in Barstow, California.

A second type of central solar energy conversion is OTEC, Ocean Thermal Energy Conversion. In this scheme, a power plant is mounted on a floating or anchored platform and operates between the warm waters near the surface and the cold waters of the deep. The electrical energy thus produced is then transmitted to shore directly as energy or it is used to generate hydrogen, which is piped ashore as a fuel. The concept was first tried in 1930 off the shores of Cuba and is still a challenge to engineers.

A third type of centralized solar energy is SPSS, Solar Power Satellite Systems. The idea is to construct large arrays of photovoltaic cells in geosynchronous orbit and transmit the electrical energy by microwaves to earth where it would be received by rectennas (receiving antennas), converted back, and transmitted to load centers. Although this may one day be our source of energy, there are tremendous technological and environmental problems. The effect of microwaves on living organisms is still not well understood.

## GEOTHERMAL ENERGY

Among various alternate solar energy sources, geothermal energy must also be considered.

We know that the inner core of the earth is very hot. This heat can be used to advantage in a variety of ways. The simplest is to use the hot water from the inside of the earth for direct heating. This is done extensively in Iceland, where tropical fruits like bananas are grown in geothermally heated green gardens. Similarly, hospitals, churches, and swimming pools have been heated by geothermally heated waters.

Another approach is to use the steam produced inside the earth to turn over steam turbogenerators, and this is being done extensively at the geysers in California. About 500 megawatts of electricity are produced at the geysers and supply power to locations in California. It is expected that the production rate will soon double.

Another possibility of using geothermal heat is to drill

*(Continued on page 37)*

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*"Fortunately for the security and safety of the world, there are alternatives [to the plutonium breeder reactor]. A partial list includes developing and improving reactors that do not depend on the wide circulation of nuclear explosive material; these technical alternatives need more vigorous exploration."*

# Nuclear Power: A Boon or a Menace?

BY HENRY S. ROWEN

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AND BEVERLY C. ROWEN

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THE clash between those who see nuclear energy as vital in a world of rapidly depleting fossil fuels and those who see great dangers from nuclear energy has reached a critical stage. Nuclear energy is becoming a significant contributor to energy supplies in the industrialized countries, but just as this stage is being reached, opposition to nuclear power has intensified and its future is in question.

It is in doubt for two principal reasons. First, on environmental grounds there has been rising opposition to many large construction projects, and nuclear projects are attracting a disproportionate amount of resistance. Second, there is rising concern that the spread of civilian nuclear technology is giving more and more countries the capacity to make nuclear weapons. The debate is increasingly focused on this second point.

The event that triggered mounting concern that countries might use civilian nuclear technology for military purposes was India's detonation of an atomic bomb in 1974.<sup>1</sup> Because India had moralized for years about international affairs, Westerners optimistic about the superior wisdom of the Third World in the international arena were shocked; the shock was not moderated by the fact that India exploded her bomb with material taken from a civilian research reactor that had also been supplied with American heavy water in clear violation of the spirit of her agreements.

This event was followed a year later by the announcement that West Germany's Federal Republic was selling Brazil what is known in the jargon of the nuclear trade as the "full fuel cycle": enrichment technology, reactors, and reprocessing technology. In the United States, this announcement heightened alarm about the prospect that a major change was taking place, one that might rapidly lead to a situation in which many coun-

tries, including those that were unstable, could quickly procure nuclear bombs.

A little technical information is needed. The predominant type of nuclear reactor, a "light water reactor," uses as fuel a *non-explosive* material—low enriched uranium. This is uranium that has been enriched in the fissile isotope U-235 from its naturally occurring level of 0.7 percent to around 3 percent. At the other end of the reaction, the spent fuel removed from the reactor does contain an *explosive* material, plutonium. However, as long as it is imbedded in the intensely radioactive spent fuel, it is inaccessible for bomb-making purposes. This spent fuel can be stored initially in cooling ponds and eventually in deep storage sites isolated from the environment. The procedure seems to provide a barrier to terrorists or governments that might seek to make bombs.

Unfortunately, it was commonly believed that the world has so little recoverable uranium that nuclear power would not be available on any large scale unless the plutonium (which is also a fissile material) were recovered from the spent fuel and reused—recycled as it is called—as fuel. Further, it was widely held that it was important to build reactors especially designed to "breed" plutonium in order to get much more energy—50 times as much energy out of each pound of uranium as is possible with light water reactors.

## A "PLUTONIUM ECONOMY"

The importance of moving quickly to what has been dubbed a "plutonium economy" was seen as early as the Manhattan Project of World War II. At that time, the proven reserves of uranium in this country came to only 2,000 tons, about enough to run *one* large reactor for 10 years. During the 1950's, the Atomic Energy Commission (AEC) offered a good price for uranium, and large discoveries were made, enough to launch a commercial nuclear industry using light water reactors, a technology that was much easier to commercialize than plutonium breeders.

In the early 1960's, nuclear power for electricity

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<sup>1</sup>Roberta Wöhlstetter, "The Buddha Smiles: Absent Minded Peaceful Aid and the Indian Bomb," Monograph 3, Final Report, Energy Research and Development Contract No. (49-1)-3747, April 30, 1977, prepared by Pan Heuristics.

production reached the commercial stage in the United States. Installed capacity has grown rapidly since then. Today, around 50,000 MWe\* of nuclear capacity have been installed in this country, equivalent to about 50 large reactors of the type now being built. Last year, nuclear electricity provided about 12 percent of all electricity generated in the United States. A similar increase in nuclear capacity is taking place in the rest of the world; the total installed nuclear capacity outside the United States is about equal to that in this country.

Recall that plutonium is explosive whereas low enriched uranium is not. If plutonium is used as fuel, large quantities of nuclear explosive materials will be widely circulated; this highly toxic material will be transported from the power reactor site to the reprocessing plant and back, possibly half way around the globe. The quantities of plutonium involved are enormous. For instance, if 600 large reactors are operating in the world in the year 2000, they will be producing enough plutonium for about 40,000 Nagasaki-type bombs annually.

The world is not yet committed to this future, however. No commercial plutonium breeders are in operation, and they cannot become commercially important until the 21st century. Moreover, it now seems unlikely that there will be commercial recycling of plutonium for use in today's light water reactors. A decision by United States President Gerald Ford in October, 1976, endorsed by his successor, President Jimmy Carter, to defer indefinitely any commitment to this use of plutonium mixed with uranium in order to stretch the supposedly limited uranium supplies has helped to discourage this development in the United States. This decision, plus the sharply rising costs of reprocessing spent fuel, have helped chill interest in other countries.

However, several countries around the world are still planning to engage in international trade in plutonium. This is hardly surprising, since the world nuclear industry assumed for many years that such trade would occur. It was assumed that the reprocessing of spent fuel would provide a satisfactory and economical solution to waste disposal and that recovered plutonium would fuel the breeder reactors when they were perfected (which was expected to happen soon). Furthermore, there was little concern over the possible diversion of this material to weapons use because it was believed that plutonium from power reactors was not capable of

being exploded in a weapon. (This last assumption was false; plutonium from power reactors can reliably produce explosive yields equivalent to thousands of tons of TNT.<sup>2</sup>)

On the basis of technical advice, several national legislatures passed laws requiring that all spent fuel be reprocessed to minimize hazards in the storage of waste. (Here they were ill advised also; the storage of unprocessed waste is in some important respects less difficult than the storage of reprocessed waste.) Japan has a representative law, which dictates that a license to build a nuclear power plant may not be issued to a Japanese utility company until reprocessing contracts are signed. This legislation is illustrative of the interplay of contradictory concerns over nuclear power.

Along with nuclear industries elsewhere, the Japanese nuclear industry had long accepted reprocessing as a logical part of the fuel cycle—necessary to reduce electric power costs, important for the conservation of uranium resources, the source of plutonium for breeder reactor fuel, a contribution to energy independence and the safest method of disposing of spent fuel. To meet the legal requirements for reprocessing the fuel from their currently operating reactors, the Japanese have a French-designed 200-metric ton reprocessing plant at Tokai Mura (which is small and is not expected to be economic but gives them experience). Meanwhile, finding acceptable overseas reprocessing facilities to supply plutonium for Japan's breeder development program has not been an easy task. Negotiations with the British continued for over two years, and terms that include large Japanese investment in the plant facilities were drawn up. In Britain, after lengthy public hearings, the expansion of the present reprocessing facilities to permit the handling of foreign spent fuel was finally approved by the House of Commons in late March, 1978. Meanwhile, the Japanese were also negotiating with the French for reprocessing of additional spent Japanese fuel, together with the shipment back to Japan of plutonium—and the leftover wastes.

In the last six months, Japan has signed contracts with the yet-to-be-built reprocessing undertakings in both Britain and France to reprocess 1,200 metric tons and 1,600 metric tons, respectively, of spent fuel between 1982 and 1990. These contracts, together with Japan's own 200-metric ton capacity plant, will meet the requirements of her licensing laws.

This entire transaction is by far the largest deal in international plutonium commerce to date. It points up a number of problems not only for the Japanese but for the world. Underlying all the negotiations has been a general incompatibility of policy and more recently an absolute incompatibility between the domestic policy (and law) of Japan and that of the United States. A few months ago, Congress passed and President Carter signed the Nuclear Nonproliferation Act of 1978, which requires that the United States government approve the

\*Megawatts of electricity.

<sup>2</sup>Victor Gilinsky (Commissioner, United States Regulatory Commission) spoke to this point in his address to the Washington Center of Foreign Policy Research, School of Advanced International Studies, Johns Hopkins University, on November 3, 1977. He pointed out that credence no longer is given to this notion. "Information gaps have also been closed in the current version of the IAEA Safeguards Technical Manual, which provides the following guidance: plutonium of any grade, in either metal, oxide or nitrate form, can be put in a form suitable for the manufacture of nuclear explosive devices in a matter of days to weeks."

re-export or reprocessing of any fuel of United States origin. Almost all Japanese fuel has been enriched in the United States; the United States has the right of approval of the Japanese deals with Britain and France, deals which help set up both countries as suppliers of plutonium to the world.

This law requiring United States approval would not have caused much conflict until late 1976. Permission to reprocess was assumed to be automatic if certain physical safeguards were met. By asserting that the United States would put a moratorium on domestic reprocessing, Presidents Ford and Carter decisively rejected the commercial use of plutonium. Under the terms of the new United States act, as of March, 1978, the standards set for ourselves are to be applied by act of Congress to the commercial actions of other countries using United States materials and technology.

The kinds of tensions generated are also illustrated in the Japanese-British deal: United States Deputy Undersecretary of State Joseph Nye told the British at the conclusion of the hearings on reprocessing:

The United States is not prepared at this time to encourage weapons states to decide in favor of proceeding with the new reprocessing plants . . . . We cannot give any assurance that BNFL (British Nuclear Fuel Ltd.) may count on MB-10's (the document that approves transfer of spent fuel) as a matter of course for feed for a new plant or in support of long-term reprocessing commitments that it may enter into.<sup>3</sup>

This is the kind of pressure the Japanese have been openly concerned about since President Ford's decision of October, 1976.

These actions have drawn strong criticism at home as well as abroad. France is leading the opposition to the new United States export policy, claiming that we promised not to take any specific action until the pros and cons of different types of nuclear power have been carefully examined. West European officials claim the United States campaign to control and forestall plutonium commerce is counterproductive for controlling the spread of nuclear weapons because it encourages other countries to build their own nuclear-fueled facilities. To the extent that other countries do this, they will possess the means to acquire nuclear bombs.

## INTERNATIONAL CONTROLS

To understand the dangers ahead, it is important to understand the characteristics and limitations of the present international system for the control of nuclear energy. This system rests on several institutional

<sup>3</sup>Quoted by Allen Hammond in "U.S. Warns Britain on Reprocessing," *Science*, March 17, 1978.

<sup>4</sup>It is relevant to observe that the NPT contains no definition of nuclear weapons, which leaves nations free within broad limits to define that which is to be controlled.

<sup>5</sup>U.S. Department of State Publication 2498, *A Report on the International Control of Atomic Energy* (Washington, D.C.: U.S. Government Printing Office, March 16, 1946).

arrangements. One is the Nuclear Nonproliferation Treaty (NPT). This treaty calls on the non-nuclear states not to acquire nuclear weapons; in a complementary way it calls on the weapons states not to transfer nuclear weapons to others. However, it also imposes an obligation on the weapons states to share freely all civilian nuclear technology with the non-weapons states. The distinction between the civilian atom and the military atom is crucial, but unfortunately the atoms are the same. Taken literally, this NPT provision would, in effect, allow every country to make bombs.<sup>4</sup> In practice, however, there has been a certain amount of foot-dragging by the weapons states in passing on certain "sensitive" technologies; these states have also been reluctant to transfer nuclear technology to "sensitive" countries.

Thus the NPT is not a serious barrier to the spread of nuclear weapons, although the treaty signatories have signed a pledge not to make these weapons. Unfortunately, overriding security interests may dictate that nuclear weapons must be acquired and perhaps used; under stress, a nation may make a decision that violates its pledge and ignores the overriding interest of the rest of the world.

The NPT has been seriously weakened by the fact that governments that refused to sign the treaty have not had any more difficulty in obtaining nuclear materials and technology than those that have signed. Spain, Brazil and India are cases in point. As far as United States supplies are concerned, this will now change; the 1978 act states that the United States cannot transfer material to any country making nuclear explosives. Canada has preceded the United States in this direction. Shocked by the fact that India used the reactor Canada gave her to make a bomb, the Canadians ended nuclear cooperation with India (a move which the United States has refused to make) and instituted so-called "full scope" safeguards on the sale of nuclear materials, the type of safeguards now incorporated in United States law.

What role is there in this scheme of things for the international system set up to monitor nuclear technology, the safeguards operated by the International Atomic Energy Agency (IAEA)? It is instructive to know the origins of this agency. Toward the end of World War II, the United States considered the future of nuclear energy in the world. Dean Acheson and David Lilienthal headed a group that proposed that the potential for the civilian uses of nuclear energy was great but so, too, were the military dangers.<sup>5</sup> They proposed the creation of an international authority to control and operate civilian nuclear facilities for the benefit of mankind. This concept, advanced under the label of the Baruch Plan (named for Bernard Baruch, an adviser to President Harry Truman), was put forward by the United States and was killed by the Soviet Union with an assist from Great Britain. However, the

idea of promoting civilian nuclear energy internationally did not fade. In 1953, newly elected President Dwight D. Eisenhower proposed the Atoms for Peace program, in which the United States would spread the benefits of civilian nuclear energy to all. This effort overlooked the fact that military atoms are no different from civilian or "peaceful" atoms. However, in 1957, with the recognition that the spread of nuclear technology around the world required some safeguards, IAEA was established to 1) monitor civilian nuclear activities in each country, to observe that they were, indeed, civilian and 2) promote nuclear energy.<sup>6</sup> Its monitoring functions amount essentially to auditing the books of national nuclear energy agencies and making occasional physical checks. Even IAEA officials agree this is not a tight system. Current international rules allow a country to possess nuclear explosive materials, highly enriched uranium or metallic plutonium, ready for immediate use in weapons, without violating IAEA safeguards, the NPT, or even the United States Nonproliferation Act of 1978 (i.e., providing that country is using materials of non-United States origin). IAEA inspectors could take note of the amounts in a country's inventory, but that country would be within its rights to maintain the inventory.

The IAEA safeguards serve an important function in providing a system for monitoring the behavior of governments with respect to their international nuclear obligations, but its function is much more limited than is commonly realized. Today, the IAEA should be given monitoring responsibilities for the production of low enriched uranium (not a bomb material) in order to determine that highly enriched material (a bomb material) is not being produced. It should also continuously monitor spent fuel to make sure that plutonium is not being extracted.

Up to now, the central issue has not been discussed — the proposition that the world will shortly find itself in such an energy "bind" that it will have to turn to the

<sup>6</sup>The fact that there might be a conflict between these objectives did not prevent them from being imbedded in the same organization; similarly, for many years it was an acceptable procedure for the United States Atomic Energy Commission to promote nuclear energy and to regulate it. Eventually the United States split off the regulatory function to the independent Nuclear Regulatory Commission, a move which has yet to be made in the international arena.

<sup>7</sup>See, for example, Karl Kaiser, "The Great Nuclear Debate," *Foreign Policy*, Spring, 1978.

<sup>8</sup>Department of Energy estimate for "forward cost" category of \$50 a pound or less (in 1977 dollars). *Energy Daily*, July 6, 1977. There is a spread of estimates around these values. An Academy of Sciences panel, using very conservative criteria, has estimated resources of 1.8 million tons, while an advisory group of the Nuclear Regulatory Commission, on a broader basis, has estimated 5 million tons.

<sup>9</sup>See for example: George A. Vendryes, "Superphénix: A Full-Scale Breeder Reactor," *Scientific American*, March, 1977, pp. 26-35; Tom Alexander, "Why the Breeder Reactor Is Inevitable," *Fortune*, September, 1977, pp. 123-130; or "Breeders Promise Abundant Electricity," *Electric World*, May 15, 1976, pp. 58-61.

use of plutonium made in breeder reactors as an important fuel, despite the fact that this will bring about its wide commercial distribution.<sup>7</sup> The argument runs like this: the oil and gas resources of the world are rapidly being depleted. By the 1980's, or 1990's, certainly by the year 2000, the world production of oil, at least, will be falling. Yet the demand for energy will still be growing; this demand will be especially insistent on the part of the developing countries, which are now at a low level of energy consumption but aspire to consume more as a condition of their economic growth.

The energy options will be few. Nuclear energy aside, the only proven source that is not being rapidly depleted is coal, but it is not widely available in significant quantities around the world; and although it can be transported internationally, a large expansion in its use will create serious environmental problems. The use of solar energy, biomass, oil from shale and the like is conjectural; they may turn out to be very costly and their commercial use, at best, is a long way off. This leaves nuclear energy. But nuclear energy still faces the obstacle identified during the Manhattan Project — limitations on uranium. According to the IAEA, there are only 4.3 million tons of uranium oxide in proven and extensions of known deposits in the world at a reasonably low cost.<sup>8</sup> On fairly high projections for growth of nuclear energy, this amount would be consumed by the years 2020 to 2030 if the world does not adopt some version or another of the breeder reactor. And in order to have large numbers of breeders in operation, it is necessary to start moving, given the long time required to develop and install a complex new technology.<sup>9</sup>

This line of argument has not convinced everyone, including President Carter. There are some telling points in opposition. First, there has been a dramatic slowing down in the demand for energy. This has resulted largely from the sharp rise in energy prices over the past five years. If, as seems virtually certain, prices in real terms continue to rise, the demand for energy in 2000, or 2020, will be very much less than had been projected earlier. This will, clearly, put much less stress on the environment than would otherwise have occurred. Furthermore, recent studies show that because the energy sector makes up a small part of the total economy — typically about five percent — and because of

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*"Petroleum rationing's final advantage, apart from the fact that it would enable the federal government to consolidate its multiple regulatory strategies for conserving oil, is that it will forcefully educate the American people to the seriousness of the nation's energy problem, which the administration and Congress have failed to do."*

## More Regulation Needed: America's Energy Policy Tomorrow

BY CARTER HENDERSON

*Co-Director, Princeton Center for Alternative Futures, Inc.*

THE American petroleum industry has enjoyed an intimate relationship with the United States government ever since oil superseded coal as our most critical source of energy. Within the past several years, however, the nature of this special relationship has changed as United States self-sufficiency in oil has ended, and as the American-dominated international petroleum industry has been forced to share its control over world oil with the Organization of Petroleum Exporting Countries (OPEC).

The government's traditional role has been to help the American petroleum industry regulate production and thereby prices. But today it seems committed to subsidizing more directly the industry's search for new supplies of domestic fuels, and to using its taxing and regulatory powers to raise domestic oil prices. This, in turn, will reduce the demand for imported oil, thereby strengthening the faltering United States economy and arresting the alarming decline of the United States dollar on foreign exchange markets.

Since all the cheap, easy-to-extract domestic oil has probably been found, and since American petroleum consumption must be curbed if the United States is to remain economically and militarily secure, the outlook is for more, not less government regulation of the oil industry in the years ahead.

"Just about every form and phase of United States energy production and use is now regulated," said the Washington research organization Resources for the Future, shortly before President Jimmy Carter announced his National Energy Plan early in 1977, and what "was not regulated before the 1973-1974 oil

embargo, is now." Regulation, said RFF, now covers

price controls, environmental controls, safety issues, minimum automobile gasoline consumption per mile, appliance labeling, mandatory coal use in power plants, government-funded energy research, and so forth. Such regulation is not confined to the federal level; much of it is carried on by the state and local governments. Nor have we necessarily seen the limits of energy regulation [RFF concluded, noting that the United States Congress has been extensively considering] the divestiture or splitting-up [of the oil companies themselves].<sup>1</sup>

It is nonetheless probable that the outpouring of new energy regulations being advanced by the Carter administration and Congress to end the energy crisis will prove insufficient and that even more pervasive regulation will be required in the future, including the eventual rationing of refined petroleum products.

As recently as 1970—when the United States was still the world's largest oil producer—we needed to buy 23 percent of our petroleum supplies from abroad. By 1977, with domestic production in decline, our growing thirst for oil required us to import 47 percent of our needs, and by 1995, according to the Ford Foundation's high-level MITRE Nuclear Energy Study Group, foreign oil should account for roughly 75 percent of United States petroleum consumption.<sup>2</sup>

Foreign oil imports that cost the nation only \$3.7 billion in 1970 exploded to \$44 billion last year, giving the United States a record balance of trade deficit of \$27 billion, which helped push the United States dollar to new lows against the Swiss franc, the West German mark, the Japanese yen and other major world currencies.

The growing American dependence on foreign oil is being temporarily alleviated by crude arriving on the West Coast from Alaska's frozen North Slope. Close to one million barrels a day of this high-cost domestic

<sup>1</sup>*Resources* (Resources for the Future), January-March, 1977, p. 9.

<sup>2</sup>See a useful discussion of this report by Leonard Silk, "Planning and Dependence on Imported Oil," *The New York Times*, April 7, 1977, p. D5.

crude is now flowing through the Trans Alaska Pipeline and should continue to do so into the early 1980's. United States imports of oil from the OPEC countries, which have an estimated 80 percent of the free world's reserves, must keep increasing, however, with serious implications for the future.

On April 18, 1977, in his first report to the American people on the nation's energy problems, President Jimmy Carter drew a graphic picture of what that future would hold if oil consumption is not brought under control. "We will," said the President, "constantly live in fear of embargoes," "endanger our freedom as a sovereign nation to act in foreign affairs," "feel mounting pressure to plunder the environment," "have a crash program to build more nuclear plants, strip-mine and burn more coal, and drill more offshore wells. . . ." "Inflation will soar," the President predicted, "production will go down, people will lose their jobs." "If we fail to act soon," he concluded, "we will face an economic, social and political crisis that will threaten our free institutions."

### THE NATIONAL ENERGY PLAN

Two days later, on April 20, President Carter reviewed the nation's darkening energy outlook before a joint session of Congress, and then spelled out how he thought the United States could resolve its energy crisis, based on recommendations in his National Energy Plan. The plan stressed energy conservation to be accomplished through a whole new series of government regulations embracing incentives, penalties, restrictions, rebates, rewards, taxes and tax cuts; not to mention coercion.

A year after President Carter had alerted the nation to the urgency of its energy problems, calling for "the moral equivalent of war," none of the major regulations aimed at reducing United States petroleum consumption had been voted into law by Congress, and the United States was still without a national energy policy.

Under the astute leadership of Speaker Thomas P. "Tip" O'Neill, Jr. (D., Mass.), the House passed the President's energy program virtually intact. But it was mangled on the floor of the Senate, where the powerful petroleum and natural gas industries were better able to influence the deliberations of the relevant Energy and Natural Resources Committee, chaired by Senator Henry M. Jackson (D., Wash.), and the Finance Committee, headed by Senator Russell B. Long (D., La.), from one of the nation's leading gas and oil-producing states.

"For several years," said Senator Charles H. Percy (R., Ill.) in a statement to his Senate colleagues on October 25, 1977, "we have told each other in the cloak-rooms that we need an energy plan. Now the House has presented us with one, but we have decimated it." "I am sorely disappointed," Senator Percy added,

<sup>3</sup>The Lamp (Exxon Corporation) Spring, 1978, p. 1.

"that the Finance Committee systematically disemboweled the President's energy package by eliminating all new energy taxes."

The petroleum and natural gas industries, intent on increasing their revenues and replenishing their disappearing United States-based reserves, mounted a major lobbying effort targeted at substantially raising domestic oil and gas prices, and increasing federal government subsidies to support their search for new supplies.

President Carter was so outraged by the energy industry's lobbying campaign that he opened his press conference on October 13, 1977, with a statement accusing the oil and gas companies of "potential war profiteering in the impending energy crisis," which could develop into "the biggest ripoff in history." Petroleum industry executives, including Howard W. Blauvelt, chairman of Continental Oil, and John E. Swearingen, chairman of Standard Oil (Indiana), were quick to respond that the President had mounted an "intemperate attack" on the energy industry, and that President Carter's "energy program involves the largest peacetime tax increase ever imposed on our citizens."

By the spring of 1978, it was clear that nothing would emerge from the stalled Senate-House effort to write new energy legislation until the oil and gas industries received increased price and development incentives. These would probably take the form of removing price controls on domestic oil and gas so they could rise to foreign levels, and subsidizing the cost of searching for new domestic reserves and developing unconventional energy sources, i.e., synthesizing oil from coal or tapping into geopressurized methane deposits lying deep under the sea bed off Mississippi. On April 16, 1977, *The New York Times* carried a report out of Washington noting that earlier in the month Secretary of Energy James Schlesinger had "outlined for oil-industry officials a package of administrative actions he would take in return for industry support. The actions would provide the industry with \$35 billion more in revenues by 1985, the Secretary indicated."

While the petroleum and natural gas industries would benefit from higher prices and subsidies almost immediately, the payoff promised in increased production and energy conservation would be considerably longer in coming—if at all.

C. C. Garvin, Jr., chairman of the Exxon Corporation, noted in early 1978, for example, that "developing new energy supplies involves long lead times; in 'frontier' oil areas where there is no existing infrastructure—platforms, pieplines, terminals—as much as 12 years may be required before full production is attained."<sup>3</sup> About the same amount of time, plus the expenditure of between \$20 billion and \$40 billion, would be required to convert coal into the equivalent of from two million to four million barrels a day of an

oil-like liquid fuel, according to preliminary estimates advanced by planners in the Department of Energy.<sup>4</sup>

The assertion that higher prices will significantly conserve energy may be good theoretical supply/demand economics, but it fails to recognize that in the car-dependent American culture oil has become so essential that consumers will pay almost anything to get it. Gasoline consumption continues to rise in this country, although its price has just about doubled in the past few years. Nonetheless, attempting to cut petroleum consumption through "rationing-by-price" strategies remained a key part of the administration's energy package as it agonizingly made its way through the congressional legislative process.

The centerpiece of President Carter's National Energy Plan<sup>5</sup> was the Crude Oil Equalization Tax (COET), designed to raise domestic crude oil prices to OPEC levels. Higher crude prices would supposedly be reflected at the retail level, thereby discouraging gasoline consumption, while the special wellhead tax, it was argued, would be non-inflationary, since the proceeds (estimated at \$13 billion or so a year) would somehow be rebated to the public at large.

It is doubtful that anything short of draconian price increases could curb United States petroleum consumption to any meaningful degree, given the inelasticity of oil demand growing out of the torrid love affair Americans still have with their motorcars. A new Census Bureau study, for example, shows that despite government pleas to use energy-saving mass transit or car pools, most Americans still drive their own cars to work.

Another problem with COET is that the huge new tax would become another pork barrel so beloved by the Washington political establishment rather than being rebated to the American people. COET's billions were so alluring to Representative Al Ullman (D., Ore.), chairman of the House Ways and Means Committee, that he proposed using them to pay for a cut in Social Security payroll taxes—an idea the administration was reportedly ready to support if it would help force some kind of energy bill out of Congress.

When House and Senate conferees failed to agree even on a severely watered down version of President Carter's Phase One National Energy Plan, the White House, the Department of Energy and congressional strategists went to work to draw up Phase Two.

The switch from Phase One's emphasis on increased energy conservation and coal combustion to Phase

Two's stress on increased oil and gas production demonstrated the resounding success of the oil and gas industries' lobbying campaign and the inexorable forward march of government involvement with United States energy producers and distributors.

In examining the government's Phase Two strategy, for example, *Business Week* magazine saw the need for federal subsidies and guarantees for building a demonstration synthetic oil plant, guaranteeing synthetic oil and gas prices, introducing new coal-cleaning technologies, providing incentives for coal use, and encouraging the development of wind, biomass conversion and waste-burning technologies.<sup>6</sup>

The petroleum and natural gas industries are delighted with the United States government's apparent commitment to their basic business at the very moment when the demand for oil and gas is slowing down to an expected growth rate of just over one percent between now and 1990 and when domestic reserves are running out. At the same time, foreign expansion is less attractive than it used to be, because of the takeover of oil company properties in major producing countries like Brazil, Venezuela and Saudi Arabia, and because all oil producing countries are demanding a larger share of the income from their own fossil fuel resources.<sup>7</sup>

Seeing the handwriting on the wall, the petroleum industry has been using its vast cash reserves to diversify into new, largely unfamiliar businesses where the future seems more promising. Mobil has gone into retailing and papermaking; Atlantic Richfield has acquired the giant Anaconda copper company; Exxon is aggressively moving into micro-computers and telecopiers; Ashland is in shipbuilding; Sinclair has turned to farming; Sun Oil has bought a large chunk of Becton, Dickinson pharmaceutical stock; and almost every company in the oil business has already diversified into chemicals and additional energy sources, including coal (the industry now owns 25 percent of United States reserves), nuclear and solar energy.<sup>8</sup>

Looking for new sources of energy, predictably, has involved the petroleum industry in still more subsidies and regulations, including the United States Environmental Protection Agency's increasingly strict rules governing the strip-mining of coal and the Price-Anderson Act's \$500 million of federally underwritten insurance protection for nuclear power producers against catastrophic atomic accidents.

In his seminal book, *The Control of Oil*, the late Dr. John M. Blair, who served for 14 years as chief economist of the Senate Subcommittee on Antitrust and Monopoly, describes the traditional symbiotic relationship between government and the petroleum industry.<sup>9</sup> The growth of regulation and subsidy began in the early 1930's, when the Texas Railroad Commission began prorating that state's huge oil output in order to prevent "excess" production and price competition.

The close working relationship between the United

<sup>4</sup>*The New York Times*, February 24, 1978, p. 1.

<sup>5</sup>The National Energy Plan (Washington, D.C.: U.S. Government Printing Office), pp. 50-52.

<sup>6</sup>*Business Week*, April 24, 1978, p. 104.

<sup>7</sup>*Fortune*, February 27, 1978, p. 43.

<sup>8</sup>*Business Week*, April 24, 1978, pp. 76-88.

<sup>9</sup>John M. Blair, *The Control of Oil* (New York: Random House, 1978).

States government and international oil can be seen in events like the participation of the United States State Department and the Central Intelligence Agency in replacing the Iranian government of Muhammed Mossadeq (which had nationalized Iran's immense oil reserves in 1951) with the more compliant regime of the Shah and in the extraordinary special privileges bestowed on the oil industry, including preferential tax treatment.

"Regulation breeds regulation," asserts a recent paper prepared by the American Petroleum Institute, which goes on to observe that

In general, existing and proposed regulations are characterized by growing complexity, regulatory uncertainty, unforeseen effects, misleading use of numbers and statistics, large costs to consumers, and the spread of regulations beyond oil and natural gas.<sup>10</sup>

If this is so, why should we expect more rather than less government intervention in the energy industry? There are several reasons.

1. The energy industry will undoubtedly continue its well-financed campaign to deregulate domestic oil and gas prices, while urging expanded subsidies for its increasingly costly efforts to discover new oil and gas deposits within the United States and to develop unconventional energy sources, e.g., synthetic fuels.

Exxon's executive vice president, L. C. Rawl, for example, estimated that the petroleum industry will need to spend an average of \$25 billion to \$30 billion per year to maintain its output at current levels, which meets roughly half the nation's needs.<sup>11</sup>

Typical of the development subsidies flowing into the oil industry was the announcement in October, 1977, that \$60.5 million of Department of Energy money was destined for the Occidental Petroleum Company, to support its underground "in-situ" method for recovering petroleum from oil shale.<sup>12</sup>

2. Each increase in the order of magnitude of technological mastery and managerial control over our industrial society inevitably calls forth a concomitant order of government coordination and control.<sup>13</sup>

3. Market-oriented supply/demand economics, which incorrectly holds that higher prices will always produce increased supplies, cannot be relied on to end the United States energy crisis. As a result, the United States must move toward other resource-distribution systems.

Resource-distribution systems can be studied from

<sup>10</sup>"How Oil Price and Allocation Regulations Actually Work" (Washington, D.C.: American Petroleum Institute).

<sup>11</sup>L. G. Rawl, executive vice president, Exxon Corporation, remarks at the Dresser Industries Second Annual Engineering and Technical Conference, November 15, 1977.

<sup>12</sup>*The New York Times*, October 6, 1977, p. D9.

<sup>13</sup>For a discussion of this concept, see Hazel Henderson, *Creating Alternative Futures* (New York: Berkley Publishing, 1978), p. 84.

the perspective of several major disciplines, including political science and information theory, as well as economics. They can also be examined from the viewpoint of different technological system configurations embodying distinctly different resource-distribution theories and design criteria as illustrated, for example, by the telephone system and the electrical energy supply grid system, both of which predate the petroleum distribution system and are equally essential to the American way of life.

The telephone and electricity grid systems are based on completely different theories and modes of resource distribution. The telephone system's negative feedback mechanism that protects it from overload is, of course, the busy signal, which tells customers that the system cannot handle any more demands and that they must wait in a queue for access to the service.

In contrast, the electrical supply grid has no feedback mechanism to safeguard it against overload. When the user flicks the "on" switch, power is pulled from the total system, regardless of the consequences.

The United States petroleum distribution system is apparently analogous to the electrical supply network; there is no rapid feedback to the user warning imminent system breakdown. Petroleum price increases certainly do not meet this need; they are slow to take effect, incapable of reducing demand by any predictable amount and inequitable. To make matters worse, oil price increases cannot educate consumers to the true nature of the petroleum problem beyond the immediate supply/demand situation.

Our current oil distribution system, in fact, will keep meeting consumer demand as long as motorists and others have money to spend—regardless of adverse effects on our economic, environmental, or international well-being. The petroleum distribution system, in other words, will survive by debilitating the larger national system.

## RATIONING

All of which raises the question of what alternative petroleum distribution system could give the United States control over its energy future in an efficient, cost-effective and equitable manner. One answer is petroleum rationing, a resource distribution alternative that has largely been precluded from the energy debate.

A Contingency Rationing Plan currently being refined by the Department of Energy is available to the President under provisions of Title II of the Energy

(Continued on page 33)

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*"The government's role in a predominantly market-oriented economy is to define policy, to set priorities and to create a framework conducive to the implementation of policy by the private sector."*

# The Government's Role in the Energy Crisis

BY FERN RACINE GOLD AND CHARLES K. EBINGER

*Senior Associates, Melvin A. Conant Associates*

**A**FTER the 1973-1974 oil embargo and the associated, if belated, recognition of the consequences of United States dependence on foreign oil supplies, the goals of United States energy policy were self-evident. Project Independence,<sup>1</sup> boldly and prematurely proclaimed by the administrations of Presidents Richard Nixon and Gerald Ford, called for reduced energy demand through conservation (both the more efficient use of a given quantity of energy resources and the use of quantitatively less energy) and increased domestic energy production (through the accelerated development of indigenous coal, oil and gas resources and nuclear energy). The combination of reduced energy demand and increased indigenous supply was designed to meet the fundamental goals of energy policy: reducing United States dependence on foreign energy sources and reducing the constraints on United States freedom of maneuver in international affairs derived from that dependence.

In addition, international cooperation embodied in the International Energy Agency (IEA) and the creation of a one-billion-barrel strategic petroleum reserve were perceived as vital mechanisms to insulate the economy from potential, short-term supply disruptions. Finally, a diversification of sources of oil imports that would still be essential during the transition period from oil to domestic and alternative energy resources would enhance United States national security.

The goals are not new; virtually every postwar President has argued that United States national security requires United States energy independence. Moreover, the goals, as restated in President Jimmy

Carter's National Energy Program (NEP, April, 1977), remain valid even if, from the perspective of 1978, the future may hold reduced dependence and lessened vulnerability to foreign actions rather than the more grandiose and, at least temporarily, unattainable domestic energy independence.

Widespread agreement on goals, however, obscures equally broad disagreement as to appropriate and effective means. Much of the debate on means revolves around the issue of government regulation of the private energy sector and the effects of government involvement in energy affairs on the achievement of United States energy objectives. Proposals run the entire gamut from reduced government involvement and the unfettered operation of the market on the one hand to regulation of the private energy companies as public utilities, nationalization of the domestic oil industry and/or the creation of a federal energy company, on the other.<sup>2</sup>

Classical economic theory suggests that in a competitive system the unrestricted operation of the market mechanism reflected in higher energy prices would induce conservation among energy users and provide sufficient incentive for energy producers to find and develop domestic energy resources. Price and self-interest result in the most efficient allocation of resources and restore equilibrium between supply and demand. The government's role, if any, is circumscribed. The Keynesian reformulation suggests that the government has a larger role to play in eliminating the swings in the business cycle from boom to bust. Government fiscal (tax and expenditures) and monetary policies are designed to eliminate the extremes in the business cycle, but the emphasis is still on the more efficient operation of the free market.

Those who stress the need for greater government involvement imply that the market mechanism is not functioning or that the market is functioning but brings results that are inadequate to meet national objectives, or that the functioning market will indeed accomplish national objectives but not in time or at too high a cost or with unacceptable consequences.

<sup>1</sup>See Federal Energy Administration, *Project Independence Report* (November, 1974).

<sup>2</sup>For a discussion of the various roles proposed for the United States government, particularly in the international oil area, see Melvin A. Conant and Fern Racine Gold, *The Governance of International Oil: The Proper Roles of Government and Private Industry* (Mt. Kisco, New York: Seven Springs Center of Yale University, 1978), and Robert B. Krueger, *The United States and International Oil* (New York: Praeger Publishers, 1975).

With respect to crude oil prices, price has rarely been free to move in response to market forces. In the first instance, state government authorities like the Texas Railroad Commission effectively tailored oil production to anticipated demand in order to maintain a desired price level. Initially adopted as a conservation measure, pro-rationing served to buttress United States prices at a level higher than world prices. Similarly, the federal government's oil import program in effect from 1959 to 1973 protected relatively higher domestic crude oil prices from the competition of lower cost imports. The national interest in secure oil supplies, it was argued, required protected, higher domestic prices to maintain and encourage domestic production, forestalling United States dependence on foreign oil (although this policy accelerated the depletion of indigenous supply).

Given the early recognition of the need for high oil prices and the past tolerance for relatively high oil prices in order to restrain demand and to encourage domestic production, continued government control of crude oil and product prices appears oddly inappropriate. Not only were price controls maintained (after the expiration of the more general price controls of 1971-1972 instituted for domestic economic reasons), but the 1975 Energy Policy and Conservation Act (EPCA) actually rolled back oil prices. The need for higher oil prices was tempered by the desire to avoid renewed inflationary pressures and restraints on a still precarious economic recovery. Higher oil prices were to be phased in while United States consumers remained protected from the full extent of the international oil price rise by an extraordinarily complex program of government regulation<sup>3</sup> (designed, incidentally, to equalize the competitive positions of United States oil companies in the domestic market and to keep a lid on prices).

There is a consensus that higher oil prices are necessary; but there is little agreement as to the appropriate price and who should benefit from higher prices. Is the appropriate price of oil the world price as determined by OPEC? Is the appropriate price the replacement cost of a depletable resource? What is the replacement cost? Is price based on production cost more appropriate?

President Carter's National Energy Program would maintain controls on oil prices indefinitely but would raise prices to consumers via a wellhead tax equal to the difference between domestic oil prices and the international price. The revenue generated by the tax would be refunded to the public.

<sup>3</sup>According to the legislation, oil already discovered and in production, the so-called old oil, would be controlled at \$5.25 a barrel; oil subsequently going into production, new oil, would be controlled at \$11.28 a barrel. A composite price of over \$12.00 a barrel to any refiner would be maintained. Carter's NEP includes a provision for new, new oil (oil discovered after April 20, 1977) to be price decontrolled in stages over a three-year period.

<sup>4</sup>"Energy: Where Did the Crisis Go?" *The New York Times*, April 16, 1978.

The mechanism of a wellhead tax and the rationale for continued control of oil prices are related to the question of who should benefit from higher oil prices. They are expressions of an unwillingness on the part of the administration to allow the oil industry to make what the administration considers to be "windfall profits" on oil already available. The administration argues that the uncontrolled price of new, new oil is sufficient incentive to the industry to encourage domestic exploration and development. In Congress, the wellhead tax is being held up by those legislators who believe that some portion of the tax revenue thereby generated should be returned to the oil industry or channeled to a fund to finance the development of new energy sources. The industry has criticized the NEP as lacking in production incentives and suggests that higher profits are necessary to provide money for investments in new and alternative energy sources.

In the future, additional oil and gas resources will have to come increasingly from expensive enhanced recovery techniques and newly discovered fields—particularly offshore. Current pricing policies discourage tertiary recovery techniques that remain controlled (although the NEP as proposed by the President would free tertiary recovery oil). Moreover, the use of a composite regulated price means that new oil additions to production at the upper-tier price or the world price simply force down other prices so that the composite price is held at government-specified levels. Finally, the continued debate generates uncertainty that is not conducive to private initiatives.

Oil and gas prices have increased since 1973, giving some credence to the likely effect of higher oil prices. There is evidence that higher oil and gas prices have resulted in oil savings via conservation and switching to alternative energy sources (although some of the savings may be attributed to continued weak economic performance). While oil production, excluding Alaska, continued to decline it did so at a slower rate.<sup>4</sup> The available evidence suggests that price decontrol could restrain demand and increase production. In addition, almost all energy forecasts indicate that oil supply is sensitive to price and that higher prices will bring on increased production, albeit with a time lag.

Other government policies will affect the ability of the oil industry to finance oil developments. It is ironic that in the post-1973 period, when the contributions of these companies in terms of managerial and technological expertise and capital are of increasing importance in developing domestic oil resources and foreign sources outside the Middle East, the United States government has modified the foreign tax credit and depletion allowance in ways contrary to a policy which would encourage new exploration and development activities. Moreover, given the potential importance of the offshore area, the government's OCS leasing policy continues to be slow, and it is delayed even further by litigation.

To reduce oil demand and increase oil supply most petroleum industry forecasts assume: (1) decontrol of oil by June, 1979 (EPCA expires); (2) no windfall profits tax added after that date; (3) no changes in the 1954 OCS Lands Act; (4) average annual leasing of 1.5 million to 2 million acres of OCS lands for exploration and development; and (5) no vertical divestiture.<sup>5</sup> Even with these issues resolved (and they have not been), most forecasts predict that United States oil imports will be in the range of 11-15 MMB/D by 1985, far greater than the NEP's 6 MMB/D.

## **NATURAL GAS INDUSTRY**

In contrast to oil, government regulation of natural gas prices through the Federal Power Commission had the effect of maintaining relatively low natural gas prices in the regulated interstate market. These lower prices for a premium fuel resulted in increased consumption, while supply flowing to the interstate market was reduced and supply was diverted to the unregulated intrastate market.

In the NEP, the administration called for continued regulation of natural gas prices but at a higher level and with extension of federal regulation to the intrastate market. The administration has argued that higher prices would not necessarily result in increased supply; there is considerable debate as to whether the resource base actually exists to increase production significantly. However, the United States Geological Survey estimates that inferred natural gas reserves (reserves that may become available at higher prices) are equal to proved reserves (reserves currently exploitable at existing prices and with existing technology).

And in a final irony, the United States government (albeit at a painfully slow pace) is approving contracts for the importation of liquefied natural gas (LNG) at prices significantly higher than the regulated price of domestic natural gas (\$3-\$5 per million cubic feet versus the \$1.75 proposed in the NEP). Not only do these LNG imports contradict the government goal of reducing United States dependence on imports, but LNG imports also originate in OPEC countries, multiplying United States dependence on these nations.

## **THE COAL INDUSTRY**

United States coal reserves are substantial, largely recoverable with existing technology and capable of supplying a considerable proportion of United States energy needs well into the next century. Yet throughout the post-World War II period, coal as a percent of the United States energy budget declined as relatively low-cost, cleaner and easier-to-handle oil and gas resources (the price of gas, as we have seen, was held down by

government regulation) became available. Three-fourths of current coal use is accounted for by electric utilities; the rest goes largely to industrial users.

The President's NEP called for a doubling of coal production and use by 1985, designed to save some 2.4 million barrels a day of oil. The President proposed that existing utilities and industrial facilities using oil or gas would be subject to a tax designed to encourage them to convert to coal. New facilities would be prohibited from using oil and gas. By 1985, coal production is to reach more than one billion tons.

While the President's coal conversion plan remains locked in Congress, higher oil and gas prices and uncertainty regarding the continuity of oil and gas supplies have already resulted in increased coal production and use. In 1977, coal production increased to 673 million tons (from 665 million in 1976) in spite of the miners' strike. In fact, in anticipation of the strike coal production reached 16 million tons a week or an annual rate of 840 million tons.

In addition, without the enactment of legislation, utilities are converting to coal and have been doing so since the 1973 oil embargo; current plans suggest that utilities will install some 241 coal-fired boilers by 1985, requiring an additional 400 million tons of coal a year. The industrial use of coal increased 15 percent in 1977. Even in the absence of legislation, the market is apparently responding to higher oil and gas prices by encouraging conversion to coal.

Coal has not been subject to price controls in the post-1973 period. However, increased coal production and usage will be affected by a number of other government policies. The President's call for increased coal production and utilization ignored the necessary trade-offs between energy and the environment.

Chief among the government policies that will affect coal utilization are the Clean Air Act and federal strip mining legislation. Without relaxation in federal air quality standards, some facilities will be prohibited from burning coal. Facilities in areas exceeding clean air standards—by and large industrial areas—will be limited in their ability to convert to coal; those areas which most need to convert will be unable to do so. This fact has been recognized in the congressional debates on the NEP and Congress has chosen to exempt such facilities from the coal conversion tax. Under these circumstances, coal use will remain demand-limited, and coal companies may not invest in new coal-producing facilities without some greater assurance that demand for additional tonnage exists.

The uncertainty regarding the future role of electric power in United States energy supply further limits demand. Expanded use of coal requires the expanded use of electric energy. But utilities are having increasing difficulties in receiving approval for sites, and long delays involving judicial proceedings brought by environmental groups continue to plague the industry.

<sup>5</sup>See Herman T. Franssen, Congressional Research Service, "U.S. Energy Demand and Supply, 1976-1985, Limited Options, Unlimited Constraints" (Washington: U.S. Government Printing Office, 1977), p. 2.

Coal also competes with nuclear energy in electricity generation and the uncertainty regarding the further development of nuclear energy increases the uncertainties facing coal utilization.

Other environmental considerations affect coal utilization and supply. It is believed that the major share (55 percent) of new coal production will come from the western part of the United States, where low sulfur coal is available.<sup>6</sup> However, much of this additional coal (46 percent) will be recovered via surface mining. While western coal is low in sulfur it is also low in heat content, suggesting that larger quantities must be mined, perhaps causing more environmental disruption than an equivalent volume of eastern coal, which is deep-mined and has a high heat content but which is also high in sulfur. Unless the emissions problem can be solved technologically, western coal will be vital to meeting the nation's energy goals, but development of western coal resources may be inhibited by strip mining legislation. Western coal is also far from established markets, and additional transport facilities must be built. Finally, water requirements for the mining industry will further stretch an already tight water availability situation in the western states.

Last, a great deal of United States coal resources are located on federal lands. In spite of the recognition that coal resources should be developed as rapidly as possible, the Department of the Interior placed a de facto moratorium on coal leasing from 1971 to 1976.

## NUCLEAR ENERGY

From the dawn of the atomic era, it was recognized that the close association between the technological know-how needed for the development of commercial nuclear power and the construction of nuclear weapons necessitated a major role for the government and/or the international community in all aspects of nuclear research and development.

With the failure of the United States 1945 initiative (Baruch Plan) to turn the control of the world's fissionable materials over to a supranational authority, the United States enacted the Atomic Energy Act of 1946. The Atomic Energy Act transferred to the United States government complete ownership of all fissionable materials and all facilities capable of producing sufficient fissionable materials for the construction of a nuclear weapon. The act classified as secret all information relating to the use of fissionable materials for the production of electric power and banned the exchange of any information with other nations regarding the utilization of nuclear power for "industrial purposes."<sup>7</sup>

The government contracted with the academic com-

munity and private industry to develop facilities to manufacture the fissionable materials needed for the government's nuclear weapons program. This system remained intact until the enunciation of the Atoms for Peace Program in 1953.

The decision of the United States government in 1953 to share the benefits of peaceful nuclear technology with the rest of the world substantially changed the relationship between government and the private nuclear sector. Under the Atomic Energy Act of 1954, the private sector was granted the right to own nuclear facilities and to hold fissionable materials under license. The government also provided the nuclear industry with substantial financial subsidies to ensure the commercial development of nuclear electric power. With further legal changes legislated in the 1960's, by the early 1970's the ownership of the domestic nuclear industry had been completely privatized, with the exception of government ownership of nuclear enrichment plants. However, the government maintained control of the licensing and regulation of domestic nuclear power plants and review of all nuclear export sales.

By the mid-1970's, the initial euphoria over the projected benefits of commercial nuclear power (low-cost, clean-burning fuel, unlimited supply) was under attack. The burgeoning capital costs of nuclear power plants, concern over the long-term environmental effects of nuclear wastes and the safety of nuclear power plants, the potential for nuclear terrorism, the availability of uranium reserves and the danger of nuclear weapons proliferation raised questions in the minds of many critics of the nuclear industry as to whether the social costs of nuclear power outweighed the social value of a nuclear-based economy. This concern was exacerbated by the near-term horizon development of the breeder reactor and the advent of the plutonium economy.

Perhaps the key that led to concern over the worldwide expansion of nuclear power was the Indian nuclear

(Continued on page 35)

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<sup>6</sup>See Herman T. Franssen, Congressional Research Service, *Project Interdependence: U.S. and World Energy Outlook through 1990* (Washington, D.C.: U.S. Government Printing Office, 1977), p. 225.

<sup>7</sup>Atomic Energy Act of 1946, Section 10(A).



## THE NATIONAL ENERGY PROGRAM

(Continued from page 12)

subsidy for geothermal energy places alternative energy sources including, for example, solar, wind, and fuel from waste, at a relative disadvantage.

Strong endorsement is given by the President to the amendments to the Outer Continental Shelf Lands Act now being considered by Congress. Current economic research shows that the competitive bonus bidding system now in effect has produced more than fair market value to the government and has introduced a low level of inefficiency into the production process.<sup>9</sup>

The quality of the economic analysis supporting the President's program appears to be poor. First, the analysis argues that "Without constraints, U.S. oil demand probably would grow at the postwar rate of 4 percent per year, and reach 25 million barrels per day by 1985." This projection appears to assume that the demand for oil has a long-run elasticity of zero, a highly unlikely condition. Price appears to have been ignored in the analysis. In the absence of intervention, the price of crude oil would be about \$14 per barrel, currently, compared to about \$3 per barrel when the postwar consumption growth rate used in the above quotation was being established. At higher prices prevailing under uncontrolled conditions, people will economize (conserve), and consumption growth rates will be reduced.

Second, the analysis sets out to reduce "energy consumption." This is a myopic view of economic problems. Conservation, as an economic problem, requires that *all resources* be conserved, not just energy. Policies that use tax incentives and the allocation power of government to mandate reduced energy consumption lead, through resource substitution, to higher consumption of other resources (copper, insulation, steel, and the like) as if they had no value.

### PRICE CONTROLS CREATE SHORTAGES

The most important issue in the President's energy plan is price policy. Two major alternative policies are available. First, the price system can be allowed to allocate scarce energy resources among competing uses, with government interference limited to correcting for significant externalities. This would also constitute a "comprehensive national energy policy." Second, price controls can be retained, with the government making the important economic decisions about energy prices and about who is to be favored with artificially low-priced energy. The President clearly chooses the second alternative. "The President is committed to the retention of domestic oil price controls for the foreseeable future. . . ." For natural gas, the President proposes

that price controls be extended to include intrastate natural gas as well as synthetic natural gas.

The nation has had a long history of periodic experience with price controls. In the case of natural gas, the Federal Power Commission has controlled well-head prices of interstate gas since 1954. These controls have created massive shortages.

After noting, first, the inconsistency in the present system which permits gas transported in intrastate commerce to be free of federal price controls while the wellhead price of gas flowing in interstate commerce is subject to control by the Federal Power Commission, and second, that, under FPC control, natural gas "is now the nation's most underpriced and oversold fuel," one would expect that the President would call for decontrol of new natural gas supplies. Instead, he recommends the opposite, that wellhead price control be extended to include intrastate gas. This policy is recommended as "an important first step toward deregulation."

In addition to expanding the regulatory burden to include intrastate gas, the President proposes a complex and expensive six-tier system of controls with price distinctions based on (i) new gas, (ii) old interstate gas subject to existing contracts, (iii) old interstate gas made available at the expiration of existing interstate controls, (iv) the same class of gas formerly sold in intrastate commerce, (v) "specific categories of high cost gas," and (vi) synthetic natural gas.

Further, the President proposes an incredibly complex and confusing system of user taxes. In the long run, these taxes would be paid by consumers. No tax is specified for residential customers for whom prices are to be kept low. A rationing system would be established, requiring that the more expensive gas be allocated to industrial users, not to residential and commercial users. By keeping gas prices low for consumers, normal incentives leading toward home insulation and toward solar heat applications are reduced.

A simple alternative involving insignificant administrative and resource misallocation cost is available. Let the market allocate this scarce resource by (i) not extending control to intrastate gas, (ii) immediately decontrolling all newly discovered interstate gas, and (iii) phasing out over a period of not more than five years all controls on the price of existing interstate production. This also is a national energy policy.

The President appears to be proposing four tiers of oil price controls. First, the present price of \$5.25 per barrel for "old oil" is to be continued. Second, it is proposed that the present fixed price of \$11.28 per barrel be continued. This price category has included what has been called "new oil." The designation now proposed by the President is "previously discovered oil."

Third, another price category to be called "newly discovered oil" is to be given a fixed "current world

<sup>9</sup>Testimony of W. J. Mead before the U.S. House of Representatives Ad Hoc Select Committee on Outer Continental Shelf, May 19, 1977.

price." All three tiers are subject to general inflationary price increases.

As a fourth tier, incremental tertiary (not including secondary) recovery and stripper oil production is to be free of controls. This provision, viewed alone, is welcome. However, as part of a four-tier producer pricing system, it is difficult and expensive to administer.

The four tiers of price controls described above are producer prices. Market prices are to be allowed to rise to world oil prices, and the difference between the producer and market price is to be collected by the government in a four-tier taxation system.

### THE PRICE CONTROL DILEMMA

The dilemma in which government finds itself arises out of the fact of a fourfold increase in the price of crude oil beginning about 1973. This fact has led to two government "hang-ups." One is based on "windfall profits," the other, on the impact on the poor.

For all remaining oil reserves existing at the time of this price increase, substantial inventory profits would occur as a result of the large increase in crude oil prices. These "windfall" profits would be shared by private and government landowners (not oil companies) in the form of royalty payments, and lessees consisting of about 10,000 crude oil producers.

1) For all oil discovered on leases purchased after about 1974 when prices reached their present level (adjusted for inflation), the term windfall gain would not be appropriate if applied to producing oil companies. It would apply to the royalty interest, but in most cases this interest is held by federal or state governments.

2) Apart from the politics involved in the windfall gain terminology, it is not clear from the point of view provided by economic analysis that there are windfall gains even for reserves existing prior to 1973. Oil is a nonrenewable resource. It is possible that owners of oil reserves have long been expecting price increases. During the 1950's and 1960's any expected price increases failed to materialize. From 1950, when crude oil prices averaged about \$3.07 per barrel, to 1977 when prices of imported crude amounted to about \$14, the real price of crude oil (adjusted by the wholesale price index) increased at a compounded annual rate of 3.29 percent. This corresponds closely with the average real rate of return on capital over many years of United States history. It is possible that, in 1950, owners of oil resources did in fact expect this kind of gain. The problem is that the gain failed to appear from 1950 through 1970, then in 1973 it came suddenly.

3) If the government is to use the windfall gain concept as an excuse for price controls, then why single out crude oil prices when some other prices have also increased sharply?

4) How long are prices to be controlled in the name of historical windfall gains? The longer that prices are

controlled, the greater are the distortions and the greater the accumulated cost of administration, both for the government and for complying industry.

The second hang-up concerns the impact on the poor as a result of a sharp increase in the cost of crude oil and consequent product price increases. In order to avoid an adverse impact on the poor, government policy has sought to suppress price increases by using crude oil and natural gas price controls. This is an income redistribution policy. But it also distorts the flow of resources in the economy.

The income redistribution effect is haphazard. For example, poor people who do not have a natural gas hookup do not benefit from artificially low prices of natural gas, but owners of large houses with winter gas heat and summer gas air conditioning, plus swimming pools heated by gas, benefit immensely. The lesson to be learned from this experience is simple—do not adopt policies which have major resource misallocation effects in order to accomplish an income redistribution objective. Rather, if additional financial aid to the poor is desired by the nation, adopt policies that directly and efficiently (not haphazardly) serve that objective.

If the government finds it impossible politically to adjust to the new realities of crude oil prices, then the burden that we all will pay is continued price controls. The consequences of continued price controls for the nation as a whole are the following:

1) As price controls have been administered to date, they have created shortages, particularly acute in the case of natural gas.

2) The incentive to supply oil and natural gas from domestic sources is reduced. In the case of oil price controls, there is an open-ended supply in the form of imports. This leads to artificially high levels of imports and consequent balance of payments problems. It has further led to a decline in the value of the dollar in foreign exchange markets. This problem became severe in 1978.

3) Price controls involve administration costs in the form of allocations, entitlements, price policing, auditing, and the like. These administrative costs are not limited to government administration but include compliance costs imposed on industry. Whether the administrative costs of control are paid by government and thus taxpayers, or by industry, the social cost is the same.

4) When social costs are increased as a result of a control system without corresponding social benefits, economic growth and advances in living standards will be retarded. Resources that are devoted to a control system cannot be simultaneously used to produce other goods and services.

The energy message asserts a contrary result, claiming that the program would increase the GNP (gross national product) by 0.7 percent in 1978 and stimulate about 100,000 jobs by 1985. Given the mandated and

tax-stimulated reallocation of capital away from uses to which such scarce resources would flow in response to normal market incentives, these favorable results are most unlikely. A recent analysis by Chase Econometrics, an economic forecasting organization, indicates GNP and employment consequences that are more realistic and in accord with economic theory.

What are the offsetting benefits for these disadvantages? Appraisals of the social benefits of FEA have indicated negative results. A recent study by the Rand Corporation concluded that "controls have not reduced the prices of refined products." Instead, "refiners of controlled oil receive a profit transfer from the producer of the oil, but those profits are retained by the refiner."

The system of price controls has distorted crude oil prices at the expense of producers and to the benefit of refiners. It has also shifted wealth between sections of the country, principally benefiting the New England area at the expense of other regions. If there are any positive contributions resulting from the system, they do not appear to be in the area of resource allocation but rather in the area of income redistribution. Any such income redistribution benefits are highly dubious.

The universal cry for a comprehensive national energy policy is a cry of frustrated desperation reflecting a history of inconsistent, conflicting, and counter-productive energy policies. The federal government has interpreted this cry as a public demand for more federal intervention in the energy market.

However, an examination of the energy policy record leads to the conclusion that past policy has not served the general welfare. Instead, government has responded, as one should expect, to dominant organized pressures from the oil industry, the coal industry, labor unions, environmental groups, special consumer interests, and the like.

Unfortunately, there is no evidence to suggest that government behavior in the future will differ from the past. Political incentives are unchanged.

Therefore, the comprehensive national energy policy that most professional economists specializing in the energy area appear to favor is one that limits government intervention in resource allocation to correcting for clearly demonstrated significant externalities. Otherwise, the market, not government, should be allowed to allocate scarce resources among competing ends. ■

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## MORE REGULATION: AMERICA'S ENERGY POLICY TOMORROW

(Continued from page 26)

Policy and Conservation Act of 1975, although its implementation would require a progression of steps including approval by the House and Senate.

The United States should start moving toward a petroleum rationing system, since the energy crisis is already having—to use the language of the Energy Policy and Conservation Act—"a major impact on" our "national safety" and "national economy." The system should begin by rationing gasoline and diesel fuel, because the nation's energy crisis is largely centered on transportation, which uses the equivalent of just over half of all the crude oil consumed in this country (compared to less than one-third in Europe).

The oil rationing system should be calibrated to slow, halt, and then reverse the growth of petroleum consumption in the United States. Gaining control over the consumption side of the oil equation is the single most effective step the federal government can take in solving the nation's energy crisis. The supply side will be increasingly beyond its control, because of the continuing decline in United States oil reserves, the uncertainty of OPEC and Arab oil diplomacy, and the large time and cost factors that are restraining the development of synthetic fuels.

Living with less energy should not be demoralizing; Americans already consume nearly twice as much energy per capita as the equally affluent West Germans, Swedes and Japanese. In addition, a recent study for the Joint Economic Committee of the United States Congress, entitled "Energy and Economic Growth," asserts that the United States could enjoy "a robust economy" while cutting energy consumption growth to virtually zero by 1985.

Arguments have been made recently that United States levels of energy consumption are not necessarily gluttonous but must be viewed in the light of factors like the sheer size of our country. Philip H. Abelson notes correctly in his editorial in the February 10, 1978, issue of *Science* that the crude ratio of energy to gross domestic product conceals differences in energy sources, physical factors including population density, and the mix of production activities. Even after such factors are taken into account, however, the United States (and Canada) still stand out as relatively the most energy-consuming countries in the world. Residents of the United States travel an average of twice as far each year as do residents of other countries, using less mileage-efficient automobiles while shunning public transportation.

In their study *How Industrial Societies Use Energy: A Comparative Analysis*, J. Darmstadter, J. Dunkerley and J. Alterman use such comparative data to defend the United States against charges made by other nations that we are energy addicts.<sup>14</sup>

Bringing our massive and still growing consumption of oil under control could quickly reduce our huge trade

<sup>14</sup>J. Darmstadter et al., *How Industrial Societies Use Energy: A Comparative Analysis* (Baltimore: Johns Hopkins Press, 1977).

deficit, strengthen the United States dollar overseas, and slow inflation at home. These economic benefits would offset the cost of the rationing program.

A crucial subsidiary advantage of gasoline rationing would be the protection of existing jobs and the creation of new jobs. In his November 8, 1977, address to the nation on energy problems, President Carter noted that

Every \$5 billion increase in oil imports costs us 200,000 Americans jobs. It costs us business investments. Vast amounts of American wealth no longer stay in the United States to build our factories and to give us a better life.

Mandatory gasoline rationing would undoubtedly create still more thousands of new jobs because domestic purchasing power will be diverted from foreign petroleum sellers—and highly automated United States and overseas oil refineries—toward more labor-intensive goods and services produced at home.

As the Department of Energy's Contingency Rationing Plan now stands—and in this regard it resembles the Office of Price Administration's World War II rationing program—all licensed drivers would receive the same periodic entitlement to gasoline supplies.

The national security (both economic and physical) and the international prestige of the United States are now at risk to feed its petroleum habit; thus it is only equitable that every adult member of the society should receive a fair stake in petroleum allocation. Furthermore, the nation's entire energy enterprise is now increasingly dependent on social, taxpayer-supported investments and billions of dollars of tax subsidies to producers for exploration, construction and research and development.

Rationing was used successfully during World War II to equitably distribute reduced supplies of gasoline and other strategic materials desperately needed by the armed forces of the United States and its allies. The wartime gasoline rationing system met basic civilian needs for motoring fuel, was flexibly managed at the local level by neighborhood rationing boards, and came to be appreciated by the driving public, who felt it guaranteed them their fair share of dwindling supplies at a price they could afford.

Black marketeering and counterfeiting did not become serious until later in the war, when stepped-up German submarine attacks on allied shipping and the start of the great allied counteroffenses increased the military's need for United States oil supplies, a need which was met by sharply reducing the civilian population's monthly rations. Since wartime motorists were not encouraged to buy and sell rationing coupons on a "white market" as they are in contemporary rationing systems, the black market flourished.

Petroleum price controls went hand-in-glove with rationing during World War II, and they are also central to today's Contingency Rationing Plan. Price controls must accompany any oil rationing program.

Petroleum prices are at the heart of the equity issue because if some form of price ceiling were not imposed the system would soon degenerate to de facto "rationing-by-price" and price gauging (the "free market's" equivalent of black marketeering).

Petroleum rationing's final advantage, apart from the fact that it would enable the federal government to consolidate its multiple regulatory strategies for conserving oil, is that it will forcefully educate the American people to the seriousness of the nation's energy problem—which the administration and Congress have failed to do. In addition, the very fact that a petroleum rationing program is impending, let alone in operation, should enormously stimulate the privately financed search for inexhaustible power sources like solar energy, wind and biomass, which will usher in the sustainable energy era. ■

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## A CONSERVATION POLICY

*(Continued from page 15)*

ting of old equipment and the incorporation of energy efficiency into new energy-consuming goods as ultimate goals. There are many opportunities of both types in today's economy because the thermodynamic limits of efficiency are far from actual practice.

Ideally, the marketplace would determine the optimum investment in conservation. But the "paradox of the automobile" highlights the distortion that can occur in the price signals consumers see. Despite the profound national need for increased automobile efficiency, it makes little difference to the individual whether he buys a 15-mile-per-gallon car, or one that obtains 35 miles per gallon. Policy tools include stripping away subsidies (for example, subsidies on the importation of foreign crude oil) of energy consumption, providing incentives for conservation, and internalizing all the costs of energy consumption.

Will the conservation of energy stifle the economy, constrain technological innovation, and reduce employment? Research indicates that there need be no net difference between a high energy-use future and a low one in the demand for workers. The economy can double its present size by the year 2010 while energy use in that year can be held to a level no higher than today's. Furthermore, it will be necessary to substitute ingenuity for brute force in the consumption of energy, which means that more highly skilled workers (and fewer workers performing menial tasks) will be required.

The realization of these positive aspects of energy conservation, however, is contingent upon action to convert our energy-consuming capital stocks soon enough to avoid the necessity of major changes in consumption patterns. Such changes may otherwise be in the offing a decade or more before the end of the century. ■



## THE ECONOMIC IMPACT OF AMERICAN OIL DEPENDENCY

(Continued from page 4)

negotiations at kilometer 101 had led to an Israeli withdrawal from the Suez Canal. The "oil weapon" is, in part, a political bargaining tool. When and how oil supplies might be used for political leverage is a crucial question. Should the Saudis disapprove of the United States role in peace negotiations and alter their price restraint, the United States economy could suffer catastrophic damage. Admittedly, it is difficult to "target" a particular country, given consumer control of tanker fleets and the possible implementation of emergency-sharing provisions of the International Energy Agency. However, Saudi Arabia needs only four million barrels daily for internal consumption; to some extent, the United States is also vulnerable to an embargo against West Europe and Japan, who depend overwhelmingly on OPEC supplies. Such vulnerability can be reduced only if import dependencies are reduced, and this is unlikely.

Whatever the outcome, timing is still critical to producers and consumers. Given lower than anticipated monetary reserve gains, producing countries may not be able to withstand a long-term denial of revenues from crude. Against this, however, must be the even more questionable capacity of consumer countries and their economies to sustain a long-term absence of sizable petroleum supplies. Consumers in such a situation may have more flexibility, given the utilization of alternative sources and conservation practices, but these measures are imprecise and probably will not fundamentally alter the near-term economic equation. The producers and their governments are likewise encumbered by problems that are less susceptible to government control, like birth rates, population size, rising economic expectations, and a primary dependence on crude for revenues and political priorities. Within the interaction of these ranges, future interaction will occur.

### CONCLUSION

The oil crisis is not a temporary problem or a profit maximizing effort on the part of the petroleum industry. Rather, it is an economic crisis whose basic cause is the depletion of easily accessible and therefore relatively cheap fossil fuels. Petroleum is not inexhaustible, and we have entered an era of steadily rising oil costs. These rising costs will make occasional dislocations inevitable and will ultimately lead to structural changes in the United States economy.

Clearly, each issue in oil policy is interdependent.

<sup>6</sup>For an analysis minimizing the impact of higher oil prices, see Gottfried Haberler, "Oil, Inflation, Recession and the International Monetary System," *The Journal of Energy and Development* (Spring, 1976), pp. 177-190.

Higher oil prices fueled inflation, which helped to create a reduction in total demand. This combination led to the recession of 1973-1975 and accounts, in part, for the slow growth today. By late 1974, the real GNP (1973 prices) in the United States had been reduced by \$35 billion and added one percentage point to the unemployment rate. Moreover, double digit inflation (12.2 percent in 1974) and losses in purchasing power triggered faster wage hikes, thereby increasing inflation.<sup>6</sup>

Between now and the year 2000, there is a large probability that total energy supplies will be increased and sources of energy will be diversified. In the interval, oil and natural gas will continue to provide most of our power. The real problem, therefore, is how to manage the transitional years. Limited assistance from coal, nuclear power, hydro and geothermal energy will be forthcoming. Other sources, like solar, wind power, biomass conversion wave power, are promising but will require much research and development to solve energy storage problems and clarify real costs. Ultimately we shall move toward technologies that are less dependent on scarce, depletable natural resources. But this shift from oil and gas will alter industrial activity, demand massive capital expenditure, and the resolution of difficult public policy issues.

The United States transition from virtual self-sufficiency in oil to the position of the world's leading importer of oil has enhanced the OPEC monopoly. But OPEC nations will enjoy bargaining leverage over the consuming nations for only two decades. Even during this brief period, they will also be increasing their dependency upon industrial nations. The net effect of the United States oil dependency therefore will be to enhance OPEC's bargaining status within defined politico-economic contexts and to serve as a catalyst in reforming international political and economic relations. As the consuming nations take steps to reduce their dependence, OPEC's ability to act co-operatively may be circumscribed. For the immediate future, the United States and OPEC are mutual hostages. ■

## THE GOVERNMENT'S ROLE

(Continued from page 30)

detonation of May, 1974. Although the fissionable materials utilized by India were diverted from a research rather than a commercial nuclear power reactor, the Indian detonation generated concern as to whether the export policies of the international nuclear industry were consistent with United States government non-proliferation objectives.

Increasingly, Congress was alarmed about the extent to which the United States nuclear industry concerned itself with proliferation issues, whether the nuclear

industry placed adequate safeguard restrictions on the technology transferred by commercial license to foreign companies, whether or not the domestic nuclear industry exerted influence on its non-regulated foreign subsidiaries to act responsibly in the reexport of United States nuclear technology, and so on.<sup>8</sup>

By 1976, government regulation of the nuclear industry was a convoluted maze of bureaucratic red tape. Nuclear export licensing authority was fractured among the Departments of State, Commerce and Defense and the Nuclear Regulatory Agency, the Energy Research and Development Administration and the Arms Control and Disarmament Agency. Thus the domestic licensing process, under the confused provisions of the National Environmental Policy Act (NEPA) and conflicting federal-state licensing procedures and requirements, was almost unfathomable. Although many of these organizations had legitimate regulatory functions to perform, the long licensing process for the average nuclear plant made it impossible for the domestic nuclear industry to plan its long-term requirements and capital expenditures. The long delays also substantially raised the cost of nuclear-generated commercial power.

Although the pending Nuclear Licensing and Siting Bill of 1978 is designed to streamline these procedures, the imprecise and open-ended language in the bill gives serious cause for concern and ample opportunity for anti-nuclear forces to pose legal challenges to the construction of any nuclear facility.

Under the provisions of the bill, no explicit criteria are delineated as to the exact manner in which environmental concerns must be considered in the construction of a nuclear reactor. There are questionable provisions for a five-year "experimental" program to have government pay the costs of intervenors in nuclear licensing and rule making procedures. The bill's language leaves open-ended provisions for "full" public participation in the planning, siting and licensing of nuclear power reactors. There are nonsensical and unclear provisions declaring that conservation and solar power have equal standing with nuclear power in consideration of the need for new energy facilities. For example, adequate protection of public health and safety is the "paramount consideration" in the decision on whether or not to license nuclear power plants. Finally, the bill's granting to each state the "right" to determine for itself the need for a nuclear power generating plant gives a near-veto right to any anti-nuclear state politician.

Turning to the nuclear export field, the enactment of the Non-Proliferation Act of 1978 raises serious obstacles to the ability of nuclear industry to win valuable nuclear export sales.

Under the provisions of the act, the Nuclear Regulatory Commission has the right to block the export of

<sup>8</sup>Hearings Before the Committee on Government Operations, U.S. Senate, January, 1976, *Export Reorganization Act of 1976*.

nuclear reactors if the proposed site locations are found to be unsafe. While serious issues are involved here, the granting to the NRC of such authority raises serious constitutional issues regarding such an extension of authority to an independent regulatory commission. Likewise, it appears unlikely that foreign governments will allow this infringement on their sovereignty.

While nuclear power is an emotive issue, it is important for the American public to realize what is at stake if the current trend of events continues.

If the Nuclear Licensing and Siting Bill of 1978 is not seriously amended, nuclear power will never contribute a substantial amount of energy to our national energy balance.

While some opponents of nuclear power may welcome such a development, the implications for the nation for the next 10 to 20 years are profound. If we fall short in developing nuclear power at least at a rate commensurate with the announced goals of the President's energy program, allow labor disruption and environmental restriction to curtail the development of coal, continue to hold up the development of our fossil fuel reserves on the continental shelf and so on, our oil imports will escalate dramatically.

In actuality, the issue confronting the United States government and the private energy industries is not more or less government involvement and regulation. Given the importance of energy to the economic, political and military wellbeing of the nation, government involvement is assured and probably necessary. Moreover, regulation is not always inimical to private interests; there were few complaints from the industry regarding the oil import quota system which protected high United States domestic oil prices, and government funding of energy research and development activities is always appreciated.

The real issue may relate to the appropriateness of government policies; the real need may be to define roles for the government and private industry in United States energy development. The government has extended its role in energy—the creation of the Federal Energy Administration, the Energy Research and Development Administration, and the Nuclear Regulatory Agency in 1973-74, the authorizations embodied in the Emergency Petroleum Allocation Act of 1973 and the Energy Policy and Conservation Act of 1975, and the creation of a Cabinet-level Department of Energy in 1977—with no precise conception as to how and to what ends government authority will be exercised.

The government's role in a predominantly market-oriented economy is to define policy, to set priorities and to create a framework conducive to the implementation of policy by the private sector. Almost five years after the oil embargo and after an entire year of debate on President Carter's National Energy Plan these conditions have not been met.

The inability or unwillingness of the government—

the executive and legislative branches—to make hard political choices, to resolve conflicts between energy, economic growth and the environment, and to define the national interest (as opposed to regional, state or local interests) in energy, combined with the adversary relationship between the government and the oil companies that must play a major role in achieving national energy objectives are major inhibitions to the achievement of United States energy goals.

Compared to 1973, the United States is today more dependent on foreign oil sources for a greater proportion of its oil consumption (over 40 percent in 1976) and increased volumetric requirements (8.6 MMB/D in 1977 from 6.3 MMB/D in 1973) and is more dependent (32 percent of 1976 United States oil imports versus 15 percent in 1973) on precisely those countries that instituted the 1973-1974 oil embargo.<sup>9</sup> In spite of the creation and expense of a vast new energy bureaucracy, greater government involvement has not necessarily been a positive factor in energy developments (although to be fair, the Energy Department is new and untested). Market imperfections may require greater government involvement. However, the little evidence we have suggests that the market would and is inducing adjustments consistent with national energy goals. ■

<sup>9</sup>The embargo was instituted by the members of the Organization of Arab Petroleum Exporting Countries (OAPEC)—Algeria, Bahrain, Egypt, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, Syria and the United Arab Emirates.

## ALTERNATIVES TO THE ENERGY CRISIS

*(Continued from page 18)*

a hole to the hot rack, pump water into it, heat it and then extract it through a second hole on the surface.

Still another possibility is tidal energy, used in the eighteenth century in Rhode Island for mechanical power. Now the foremost tidal electrical power plant is located at the Rance River in France and produces about 240 megawatts of electricity. An ideal site in the United States is Passamaquoddy, Maine. If exploited, this could be a major central power plant, although the capital cost would be formidable.

Clearly, before any new technology can be put into effect, it is necessary that it be scientifically viable. Each of the alternative energy sources proposed above has already been scientifically examined. Thus, major new developments will be technological in nature, to assure that the alternative energy equipment is reliable, reasonably maintenance-free, of long duration and in compliance with local codes and standards. Mass production methods will have to be developed. This last point applies more to individualized on-site forms of alternate energy like solar hot water heating than to centralized forms, like solar thermal power plants or

tidal energy. In any case, an industry will have to develop the products and the plants to manufacture them, and will have to include distribution, sales and installation as well as maintenance services.

The economic issues for alternative energy sources are complicated. Where will industry get the capital from? The cost of centralized power systems is in the billions. How will this be financed?

In the case of distributed or on-site energy sources, can the average home buyer afford them? It is probably true that on a life-cycle cost analysis basis renewable energy devices are cheaper. But on the average, the turnover in housing is seven years, not the life span of the home. Does it, therefore, make sense to invest money in an installation that will be used for a few years and then passed on to the next owner? Furthermore, it is not at all clear how long solar installations will last.

Of course, a solar installation could be owned by a company like a utility and leased to the owner. Individuals lease cars. There is no reason why home owners should not lease their heating, cooling and electric generation equipment.

Generally speaking, alternate energy sources are environmentally benign. But this statement should be couched with caution. For example, the antifreeze used in solar collectors is poisonous and would be dangerous in case of a leak. Silicon photovoltaic cells are benign once manufactured, but the mining of silicon can give rise to silicosis. Geothermal energy can pollute the soil with salt and give off hydrogen sulfide in addition to the noise pollution it creates. All of these can be taken care of, and none is so dangerous as radioactive waste; nor are fatalities so great as in coal mining. Still, "caution" should be the watchword. In the case of Satellite Power Systems, it is crucial that we determine the effect of the microwave beam on birds in flight, airplane passengers passing through the beam, and flora and fauna.

Many institutional issues are involved. For example, who owns the sun rights? Can a person build a solar home only to be overshadowed by a high rise building built subsequently? Is a wind generator detached from a home covered by home insurance? What is the liability insurance in case a blade breaks off and lands on a neighbor's lot? Should mortgage lenders relax their rules about financial ability because monthly energy payments will be lower?

Another issue may be mentioned. Suppose a home or building owner generates surplus electricity by means of a wind generator or a photovoltaic installation. Can this owner sell back electricity to the electric utility? For example, in one state the local electric utility company was ordered to buy electricity generated by a wind generator erected on top of a building. Does the building owner become a utility?

Still another issue is who should own on-site alternate energy systems, the owner or the utility?

In the case of centralized alternate sources, who

should pay for research and development, the government or private industry?

A final question remains. Who should be held responsible—the federal government, states or local jurisdictions?

Clearly, alternate energy forms, promising as they are, raise technical and social questions. We should face these questions now, because our nonrenewable resources are running out, and we must have technically reliable and socially acceptable substitutes when the real energy crisis arrives. ■

## THE IMPORTANCE OF OIL

*(Continued from page 8)*

In such an event, an in-place capacity for the flexible rearrangement of available supplies among the United States, Japan and West Europe would be an asset. An established transportation pattern for shipments from the United States to Japan, together with increased tanker capacity in the Atlantic trade, would be an in-place capacity.

The current restriction on the flow of Alaskan oil to Japan and the consequent reduction in the potential for flexible rearrangement of available supplies in the case of a military denial of Persian Gulf oil create a new dimension of the oil weapon.

A number of conclusions can be drawn with regard to the strategic and military importance of oil. First, oil is and will continue to be important. Second, just as the original oil embargo was unexpected, any significant future world oil supply interruption is apt to have aspects that have not been anticipated. Third, the Soviet Union is apt to be strategically important in future world oil and gas markets, but as an exporter rather than an importer. Fourth, in order to compensate for both the unanticipated dimensions of any future oil supply interruptions and the probable new Soviet dimension in any such interruption, it would be desirable to make the logistic patterns in the world oil market as diverse and flexible as possible. And fifth, United States energy policy is making the world oil market both tighter and less flexible than it would otherwise be. ■

## NUCLEAR POWER

*(Continued from page 22)*

the elasticity of substitution of labor and capital for energy within this economy, the economic consequences of reduced energy use are small. For plausible values of elasticity of substitution, a reduction in end-use consumption of energy of 30 percent would reduce the value of total output by about one-third of one percent.<sup>10</sup>

Second, there are many ways of conserving the use of

uranium short of becoming involved in the dangers of the wide circulation of plutonium. Light water reactors can be made a good deal more efficient in the use of uranium; the type of reactors used by Canada—heavy water reactors—are already much more economical in uranium consumption (although more costly in other respects); new types of reactors can be even more economical. Third, the world supply of uranium available at a given real price will certainly continue to grow. The great discoveries in the United States in the 1950's were matched by large finds in Australia in the 1970's. Most of the world has been barely scratched in the search for uranium, thus much more is sure to be found.

So on balance, the earlier arguments for moving into a dangerous plutonium economy are dubious. But there is another argument for the use of plutonium and the breeder, which centers on the distribution of world resources, not their total amount. In this view, 75 percent of the world's current uranium reserves are located in four countries: the United States, Canada, Australia, and South Africa. Each presents problems as a supplier—the United States and Canada because they have been changing their export rules (e.g., insisting on "full scope" safeguards); Australia because she has been engaged in a heated internal debate on whether or not she wants to become a large uranium exporter given the consequent proliferation dangers; and South Africa, because political stability in that country is an uncertain prospect.

Still worse, from the perspective of a nervous importer, is the pattern of enrichment capacity. Today the United States has 90 percent of the non-Communist world's capacity; even though this will shrink a good deal by the late 1980's, the United States will remain a dominant supplier of this essential service.

The response of some countries is a policy of autarchy; they are trying to create within their own borders a nuclear capacity that is independent of outside suppliers. This policy has been advocated by countries who have, at times, been leaders in the opposition to nuclear weapons—Brazil is an example.<sup>11</sup> Some countries have uranium deposits they would like to exploit, but many do not; some are acquiring enrichment technology, but for many countries this is technically difficult and costly. Viewed in this light, the plutonium breeder is seen as a panacea. It promises freedom from imported fuel because once set up it can operate on minute and easily stockpiled amounts of imported uranium. However, its

*(Continued on page 48)*

<sup>10</sup>Based on calculations by Vince Taylor. Also Alan Manne and William Hogan, "Energy-Economy Interactions: The Fable of the Elephant and the Rabbit," *Modeling Energy-Economy Interaction: Five Approaches*, C. J. Hitch, ed. (Washington, D.C.: Resources for the Future, 1977).

<sup>11</sup>The *Brazilian Nuclear Program*, Federative Republic of Brazil, Brasília, March, 1977. In particular, pages 11 and 20 demonstrate this schizophrenia.



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## TWO MONTHS IN REVIEW

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*A Current History chronology covering the most important events of May and June, 1978, to provide a day-by-day summary of world affairs.*

### INTERNATIONAL

#### Arms Control

May 27—U.S. President Jimmy Carter and Secretary of State Cyrus Vance conclude negotiations with Soviet Foreign Minister Andrei Gromyko in Washington, D.C.; some progress toward a new strategic arms limitations agreement (SALT) is reported.

June 3—White House sources report that the Soviet proposal to ban testing and deployment of all new Soviet and American intercontinental missiles through 1985 has been a factor in the slowdown in SALT talks. American negotiators rejected the Soviet proposal on May 31.

June 22—In an address to the special disarmament session of the United Nations General Assembly, U.S. director of the Arms Control and Disarmament Agency Paul Warnke says that "significant progress" is being made in U.S.-Soviet arms limitation talks.

#### Council for Mutual Economic Assistance (COMECON)

June 29—At COMECON'S annual meeting, Vietnam is accepted as its 10th member.

#### International Labor Organization (ILO)

June 27—Meeting in Geneva, the ILO rejects a resolution charging that Israel is guilty of "discrimination, racism and violation of trade union rights" in Israeli-occupied territories.

#### Middle East

(See also *Egypt; Israel; Lebanon; U.S., Foreign Policy*)

June 20—U.S. State Department officials say that after studying Israeli Prime Minister Menahem Begin's proposals for Israeli-occupied territories the U.S. concludes that the proposals are probably inadequate to start a resumption of Middle East peace talks. (See also *Israel*.)

June 23—U.S. Secretary of State Vance proposes a meeting next month in Europe between Israeli and Egyptian foreign ministers to revive stalled negotiations.

#### North Atlantic Treaty Organization (NATO)

May 30—The 15 members of NATO open a conference in Washington, D.C. (See also *U.S., Foreign Policy*.)

May 31—Ending a 2-day NATO summit meeting in Washington, D.C., the organization issues a communiqué that warns the Soviet Union that its military activities and Cuba's interference in Africa "cannot but jeopardize the further improvement of East-West relations."

NATO members agree to a 10- to 15-year program to improve the organization's combat readiness, at a cost of between \$60 billion and \$80 billion.

June 20—At a news conference in Annapolis, Maryland, North Atlantic Treaty Organization Secretary General Joseph Luns reports that NATO has made plans to defend the routes used to transport Middle East oil to the U.S. and West Europe by way of the Cape of Good Hope.

#### Organization of American States (OAS)

(See also *U.S., Foreign Policy*)

June 28—In a report to the General Assembly of the OAS, meeting in Washington, D.C., the Inter-American Commission on Human Rights charges Uruguay with wholesale violations of human rights. Uruguay denies the charges.

#### Organization of Petroleum Exporting Countries (OPEC)

June 19—The Organization of Petroleum Exporting Countries, meeting in Geneva, decides to maintain the current oil price for the balance of 1978; the 13-member group is also forming a committee to study ways to protect its revenues from the decline of the dollar.

#### United Nations

(See also *Intl, Middle East; Angola; China; Lebanon*)

May 2—By an 88-0 vote, with 18 countries abstaining, the General Assembly meeting as a committee of the whole asks the Security Council to impose economic sanctions on South Africa.

May 19—The United Nations Law of the Sea Conference concludes an 8-week session; little progress is reported.

May 23—The General Assembly opens a special 5-week session on disarmament.

May 24—French President Valéry Giscard d'Estaing proposes to the General Assembly that the 35 participants in the 1975 Helsinki conference meet on disarmament.

May 26—Soviet Foreign Minister Andrei Gromyko tells the General Assembly the Soviet Union will be willing to negotiate new arms cuts involving missiles and bombers after a new SALT agreement is concluded.

June 30—The General Assembly approves curbs on arms and agrees to enlarge the Geneva disarmament conference committee.

### AFGHANISTAN

May 1—It is reported that on April 30 Noor Mohammad Taraki was named Prime Minister and head of the Revolutionary Council that took power April 27, 1978.

May 6—In a press conference, Prime Minister Taraki reaffirms that the new government is "nonaligned and independent and no country will have justification to interfere in our internal affairs."

June 14—Former King Zahir Shah and 22 members of the royal family are deprived of their citizenship by the new government. They are currently living in Rome.

### ANGOLA

(See also *South Africa; Zaire*)

May 5—In the United Nations, Angola asks the Security Council to hold an emergency session to investigate the recent "invasion by racist South African troops" into southern Angola. South Africa claims her troops were chasing guerrillas who had been engaging in terrorist raids in Namibia (South-West Africa).

## BANGLADESH

May 3—President Ziaur Rahman amends the Army Act to allow him to become a candidate in the June presidential elections.

June 4—Rahman wins 77 percent of the vote in yesterday's presidential election.

## BELGIUM

(See also *Zaire*)

June 15—Prime Minister Leo Tindemans submits his resignation and that of his government to King Baudouin. The coalition government has been unable to agree on austerity measures.

June 19—The 4 parties of the coalition government reach agreement on the proposed austerity measures. King Baudouin refuses to accept Tindemans' resignation.

## BULGARIA

June 22—In Bonn, it is announced that Bulgarian officials arrested 4 West German terrorists yesterday and immediately returned them to West Germany. The 2 countries have no extradition agreement.

## CAMBODIA

(See *Vietnam*)

## CANADA

June 2—After attempts to negotiate a new agreement on fishing rights fail, Canada and the U.S. order all ships of each other's country to leave their respective fishing waters.

June 6—The Quebec government issues a white paper outlining a policy for Quebec's cultural development.

June 12—In Ottawa, the federal government submits to Parliament a bill to revise the country's constitution; under the new constitution, the House of Commons would be increased in size, and the Senate would become the House of Federation.

June 23—It is announced in New York City that a 90-bank consortium, including U.S., European and Japanese banks, has agreed to lend Canada \$3 billion to bolster the Canadian dollar in foreign exchange markets.

## CHAD

June 2—It is reported in Paris that French legionnaires have been fighting alongside Chad forces against guerrillas nearly 260 miles northeast of the nation's capital.

## CHILE

(See *U.S., Foreign Policy*)

## CHINA

(See also *U.S., Foreign Policy; Vietnam; Zaire*)

May 2—It is reported that China recently purchased antitank missiles and the technology to produce them from France.

May 4—Prime Minister Hua Kuo-feng leaves Peking for a 6-day official visit to North Korea, his first foreign visit since he became Prime Minister.

May 11—In Peking, Deputy Foreign Minister Yu Chan delivers an official protest to Soviet Ambassador Vasily S. Tolstikov, charging that Soviet troops have crossed the Ussuri River border by helicopter and military boats and have shot and wounded Chinese citizens.

May 12—In Moscow, the Soviet Union explains that troops mistakenly crossed the border in Manchuria in pursuit of an armed criminal but denies that any Chinese

citizens were killed or injured in the confrontation.

May 15—In Peking, Romanian President Nicolae Ceausescu arrives for an official state visit.

May 19—Chai Tse-min is selected to serve as chief representative in the U.S.; he will fill the post that has been vacant for 6 months.

May 20—In Peking, U.S. national security adviser Zbigniew Brzezinski begins a series of talks with government officials.

May 29—In the U.N., Foreign Minister Huang Hua accuses the Soviet Union of "increasing its military threat to West Europe, striving to expand its influence in the Middle East and carrying out a series of military adventures in Africa."

June 5—The Vietnamese government gives Chinese ships permission to pick up Chinese citizens who wish to leave Vietnam. Nearly 83,000 Chinese have fled Vietnam in recent weeks.

It is reported in Hong Kong that the government has released 110,000 political prisoners who have been in prison since the antirightist campaign during the Hundred Flowers Movement in 1957.

June 16—In Peking, King Juan Carlos of Spain arrives for an official state visit, the first by a ruling European monarch since the Communists took over in 1949.

## COLOMBIA

June 5—In yesterday's nationwide presidential election, Liberal party candidate Julio Cesar Turbay Ayala, a former ambassador to the U.S., wins by a small margin. His principal opponent was Conservative party leader Belisario Betancur.

## COMORO ISLANDS

May 14—Following yesterday's successful coup d'état by former Cabinet Minister Said Atoumani, President Ali Soilih is placed under house arrest.

May 29—Former President Soilih is shot and killed; he reportedly tried to escape from house arrest.

## COSTA RICA

May 8—In San Jose, Rodrigo Carazo Odio is inaugurated as the country's 36th President.

## CUBA

(See also *U.S., Foreign Policy; Zaire*)

May 17—President Fidel Castro gives his personal assurances to U.S. diplomat Lyle F. Lané that Cuban forces are not involved in the fighting in Zaire on the side of the invading rebels.

June 13—In Havana, President Fidel Castro claims that U.S. President Jimmy Carter was misinformed by his aides about Cuban involvement in Zaire last month.

## CZECHOSLOVAKIA

May 30—In Prague, Soviet President Leonid I. Brezhnev arrives for a 4-day visit. He is greeted by Czech leader Gustav Husak; human rights activists are being detained by police during Brezhnev's visit.

## DOMINICAN REPUBLIC

May 16—National presidential and legislative elections are held.

May 17—Members of the army seize the election center in Santo Domingo as returns indicate a heavy vote in favor of opposition candidate Antonio Guzmán, leader of the Dominican Revolutionary party.

May 18—Counting is resumed in the election center.

President Joaquin Balaguer appears on nationwide television and announces that he will honor the outcome of the election.

May 26—Unofficial returns indicate that opposition candidate Guzmán has won the election by nearly 170,000 votes.

## EGYPT

(See also *Israel; U.S., Legislation*)

May 5—Deputy Prime Minister in charge of finance Abdel Moneim el-Kaissouny is dropped from the Cabinet; no replacement is named.

May 21—A national referendum is held to determine whether President Anwar Sadat will be permitted to censor criticism of his government.

May 23—Returns from the referendum give President Sadat's censorship proposal the support of 98.3 percent of those who voted.

June 2—The newly legitimized New Wafd party decides to disband rather than follow the regulations adopted by the Sadat government.

June 20—Despite the June 18 Israeli Cabinet vote to defer a decision on the West Bank and Gaza Strip until 5 years after peace is established, President Anwar Sadat says he will continue to seek a peaceful resolution of the Middle East stalemate.

## ETHIOPIA

(See also *Somalia*)

May 16—Government forces launch a counteroffensive against secessionist forces in Eritrea.

June 7—In Rome, a spokesman for the World Food Program says that Ethiopia will face a famine far worse than the famine of 1973-1974 unless emergency food is provided.

June 29—At a news conference in Beirut, 2 of the 3 Eritrean guerrilla groups—both Marxist—offer to end the 17-year revolt by negotiation.

## FRANCE

(See also *Chad; Zaire*)

June 26—A bomb explodes in the Palace of Versailles, destroying the contents of 3 ground floor rooms that contained valuable art works.

June 27—State Security Court officials arrest Breton separatists, members of the Breton Army, for the bombing of a wing of the Palace of Versailles.

## GERMANY, EAST

May 1—In the final action in a 3-way prisoner exchange, the government releases an American college student, Alan Stuart Van Norman, in exchange for a convicted Soviet spy, Robert G. Thompson, who has been held in a United States federal prison. On April 23, Mozambique released an Israeli businessman.

## GERMANY, WEST

(See also *Bulgaria*)

May 4—In Bonn, Soviet President Leonid I. Brezhnev arrives for 4 days of talks on disarmament with Chancellor Helmut Schmidt.

June 4—In two state elections, the Free Democratic party, a liberal member of the coalition government, is unable to win 5 percent of the vote and is therefore eliminated from all parliamentary representation in the two states.

June 6—In Bonn, Interior Minister Werner Maihofer submits his resignation, following criticism of his handling of the crackdown on urban guerrillas.

June 26—Chancellor Helmut Schmidt leaves Bonn on a 5-day official visit to Nigeria and Zambia. He is the first German Chancellor to visit black Africa.

## GHANA

(See *U.S., Political Scandal*)

## GREECE

May 10—Foreign Minister Panayotis Papaligouras resigns his Cabinet post; he is replaced by Minister of Coordination George Rallis, leader of the Neo-Liberal party.

## ICELAND

June 26—Prime Minister Geir Hallgrímsson's coalition government fails to win a majority in yesterday's general election; however, the left wing is also unable to form a majority.

## INDIA

(See also *U.S., Foreign Policy*)

May 5—Sanjay Gandhi, the son of former Prime Minister Indira Gandhi, is sentenced by the Supreme Court to one month in jail for attempting to influence a witness in a case against him.

May 15—In an interim report presented to Parliament, a judicial commission finds that the state of emergency declared by former Prime Minister Gandhi was fraudulent and was characterized by illegality, repression and subversion of human rights.

June 5—Prime Minister Morarji R. Desai leaves New Delhi on a 12-day visit to the U.S., Belgium and Great Britain.

June 30—2 ministers and 4 aides resign from Prime Minister Desai's Cabinet.

## IRAN

May 15—Anti-government demonstrations continue in the major cities; during the last week, 9 people have been killed in clashes with government troops.

June 6—In Tehran, Shah Mohammed Riza Pahlavi appoints General Nematollah Nassiri, head of Savak, the secret police, as ambassador to Pakistan.

## IRAQ

(See also *Kuwait*)

June 7—In Baghdad, secretary general of the National Progressive Front of the ruling Baath party Naim Haddad reveals that in May the government executed 21 members of the pro-Soviet Communist party and sentenced 10 others to prison, for an attempt to overthrow the government of President Ahmed Hassan al-Bakr.

## ISRAEL

(See also *Intl, ILO, Middle East; U.S., Legislation*)

May 7—Israeli Prime Minister Menahem Begin ends an 8-day, coast-to-coast U.S. visit and says "let us negotiate peace."

May 10—Israelis celebrate the 30th anniversary of the nation's independence.

May 12—It is reported that Israel has renewed her pledge to the U.S. not to use U.S.-supplied cluster bombs except under special wartime conditions.

May 16—Prime Minister Menahem Begin expresses his government's disapproval of the recent U.S. decision to supply Egypt and Saudi Arabia with F-15 and F-16 fighter planes.

May 18—Defense Minister Ezer Weizman calls for the expansion of 6 Israeli settlements in the West Bank.

May 21—The Cabinet votes to withdraw all Israeli troops from southern Lebanon by June 13.

May 24—Prime Minister Begin wins a vote of confidence in the Knesset by a vote of 66 to 32.

May 25—The Supreme Court orders a temporary halt to work on a new Israeli settlement in the West Bank of the Jordan River.

June 18—Replying to questions asked by the U.S. on the future status of the occupied area of the West Bank, the Cabinet declares that Israel would negotiate the status of the occupied Arab territories after 5 years of limited home rule by the Palestinians.

June 19—Parliament approves by a 59-37 vote the Cabinet's position on the occupied territories.

June 25—The Cabinet rejects Egypt's unofficial recent proposal that Jordan assume control of the West Bank and Egypt, the Gaza Strip, while security measures for Israel and some local autonomy for the Palestinians are being worked out.

## ITALY

May 5—The Red Brigades announce that they are carrying out the "death sentence" of former Prime Minister Aldo Moro because the government has refused to release 13 imprisoned left-wing terrorists.

May 9—54 days after Moro's kidnapping, his body is found in a parked car in Rome.

May 10—A private funeral service is held for Moro.

A close friend and former protégé of Moro's, Interior Minister Francesco Cossiga, resigns his Cabinet post.

May 12—In Rome, Red Brigade terrorists shoot and wound Tito Berardino, secretary of a Christian Democratic party district office.

May 13—A memorial service is held in Rome for former Prime Minister Moro; Pope Paul VI attends the service.

May 16—Final election returns in the May 14 local elections give the Christian Democrats 42.5 percent of the vote; the Communists win 26.5 percent.

May 18—The Senate votes 160 to 148 to approve the "abortion on demand" bill. The law goes into effect in 2 weeks.

June 5—In Rome, 6 people are officially charged with complicity in the kidnapping and murder of former Prime Minister Aldo Moro.

June 12—In yesterday's national referendum, voters support the 3-year-old law that gives police almost unlimited authority to use firearms.

June 15—Following charges yesterday in Parliament of tax fraud, President Giovanni Leone submits his resignation.

June 23—In Turin, 29 members of the Red Brigades are sentenced to prison terms ranging from several months to 15 years; 16 other alleged terrorists are acquitted.

## JAPAN

May 2—Prime Minister Takeo Fukuda, Foreign Minister Sunno Sonoda, and Minister of External Economic Affairs Nobuhiko Ushiba arrive in Washington, D.C., to confer with U.S. President Jimmy Carter.

May 22—Tokyo International Airport officially begins full operation; nearly 14,000 policemen maintain security in and around the controversial new airport.

## JORDAN

June 15—In Amman, King Hussein marries an American, Elizabeth Halaby, and proclaims her Queen of Jordan.

## KOREA, NORTH

(See *China*)

## KOREA, SOUTH

(See *U.S., Legislation, Political Scandal*)

## KUWAIT

June 15—Ali Yasin, a moderate leader of Al Fatah (the Palestinian guerrilla organization), is shot and killed. Al Fatah accuses Iraqi extremists of the murder.

## LAOS

June 1—It is announced in Washington, D.C., that Laos will receive \$5 million worth of rice from the U.S. in 1978.

## LEBANON

(See also *Intl., Middle East; Israel*)

May 1—Israeli troops begin the 3d stage of their withdrawal from southern Lebanon.

May 15—President Elias Sarkis reinstates his former Cabinet after attempts to form a national union Cabinet fail.

May 25—PLO leader Yasir Arafat and Prime Minister Selim al-Hoss reach an agreement whereby Arafat agrees "to end all armed manifestations in the south and to help Lebanon restore its authority in the region."

June 13—Israeli troops complete their withdrawal from southern Lebanon and turn control of the area over to Lebanese Christian military units rather than to U.N. peacekeeping forces.

In an area north of Beirut, Tony Franjeh, the son of former President Suleiman Franjeh, and his wife and child and 25 others are killed in a gun battle between supporters of former President Franjeh and the Phalangist (Christian) party.

June 14—U.N. Secretary General Kurt Waldheim criticizes the Israeli decision to hand military control in southern Lebanon over to Lebanese Christian military units rather than to U.N. peacekeeping forces.

June 28—Apparently retaliating for the murder of President Franjeh's son, gunmen raid 4 Christian towns and kill 22 people.

## MEXICO

May 7—The government legalizes the Communist party and 2 smaller parties—the Socialist Workers party and the Mexican Democratic party. The Communist party has been outlawed for 40 years.

## MOROCCO

(See *Zaire*)

## NAMIBIA (South-West Africa)

(See also *South Africa*)

May 7—Because of South Africa's recent troop action in Angola in pursuit of SWAPO guerrillas, Sam Nujomo, leader of the South-West African People's Organization (SWAPO), cancels tomorrow's proposed meeting with Western diplomats at the U.N. to discuss independence for Namibia.

## NAURU

May 15—Hammer de Roburt succeeds Lagumot Harris as President.

## PANAMA

(See also *U.S., Foreign Policy*)

June 10—After 10 years of exile in the U.S., former President Arnulfo Arias Madrid returns to Panama.

June 16—U.S. President Jimmy Carter arrives in Panama to exchange documents ratifying the new Canal treaties.



**PERU**

May 19—Price increases are ordered on gasoline, wheat, milk, cooking oil, and other commodities formerly subsidized by the government.

The government postpones national elections for a constitutional assembly for 2 weeks because of rioting and looting.

May 20—President Francisco Morales Bermudez declares martial law and suspends constitutional guarantees.

May 22—5 people are killed in a nationwide general strike called by the Communist-led General Confederation of Labor to protest the recent price increases.

June 9—The government rescinds the state of emergency measures declared during the May riots.

June 18—Nationwide parliamentary elections are held for a 100-member constitutional assembly; these are the first elections since 1963.

June 19—The Popular Revolutionary American Alliance (APRA) wins 35 seats in the assembly; the Popular Christian party wins an estimated 27 seats.

**PHILIPPINES**

(See also *U.S., Foreign Policy*)

June 3—In Manila, President Ferdinand E. Marcos offers to release 5 imprisoned political leaders, including former Senator Benigno S. Aquino, Jr., and hundreds of other prisoners.

June 10—631 military detainees are released from jail; most of them had been suspected of subversion. Aquino refuses to accept amnesty.

June 12—Marcos addresses the opening session of the newly elected interim National Assembly. Sworn in as Prime Minister, he retains the presidency also.

**RHODESIA**

May 2—The transition government legalizes 2 black political parties and asks for a unilateral cease-fire.

May 9—After reconsidering its ouster of Justice Minister Byron Hove, the Executive Committee of the transition government decides "not to reverse" its April decision.

May 14—A spokesman for Bishop Abel Muzorewa's United African National Council says that the party will remain in the transition government, despite Hove's dismissal.

May 28—In Johannesburg, South African Prime Minister John Vorster asks the U.S. and U.K. to abandon their plan to include external Rhodesian guerrillas in the transition government and to recognize the accord worked out between Prime Minister Ian Smith and the 3 black moderate leaders.

June 20—In Salisbury, the first parliamentary session under the transition government is held.

June 23—In Maputo, Mozambique, the general staff of the Mozambican armed forces accuses Rhodesian government troops of killing 17 refugees from Rhodesia and 2 Belgians in an attack on a transit camp last night.

June 24—It is reported in Rhodesia that black nationalists attacked a mission school near the Mozambique border last night and killed 12 white teachers and children.

**SAN MARINO**

May 29—Results from yesterday's national election give the ruling Christian Democrats 42.2 percent of the vote and the Communists 25.1 percent.

**SAUDI ARABIA**

(See *U.S., Legislation*)

**SOMALIA**

June 22—The Somali Information Ministry claims that Ethiopian jets have bombed towns in northern Somalia.

Somali guerrilla groups claim to have captured several small Ethiopian villages in the Ogaden region of Ethiopia. Since the Somali withdrawal from the Ogaden 3 months ago, small guerrilla bands have been returning to the region.

**SOUTH AFRICA**

(See also *Intl, U.N.; Angola; Rhodesia*)

May 4—Defense Minister Pieter W. Botha says that South African troops crossed from South-West Africa into Angola near Cassinga in pursuit of guerrillas who belong to the South-West African People's Organization.

May 6—In the United Nations, the Security Council votes unanimously to condemn the recent South African raid into Angola and calls for the immediate withdrawal of all South African troops from Angola.

June 15—Prime Minister John Vorster abolishes the controversial Ministry of Information and announces the retirement of its head, Information Secretary Eschel M. Rhoodie. The Ministry has recently been criticized for channeling millions of dollars to influential foreigners as part of a policy known as "backdoor diplomacy."

June 21—General Alec Van Wyk is named to replace retiring General Hendrik Van den Bergh as head of the Bureau of State Security.

June 28—Representatives of South Africa and the U.S. end talks in Pretoria; the U.S. hopes to induce South Africa to sign the treaty banning the spread of nuclear weapons.

**SOUTHERN YEMEN**

(See also *Yemen*)

June 26—In the wake of the assassination of Yemeni President Ahmed Hussein al-Ghashmi on June 24, fighting breaks out between dissident members of the National Liberation Front and those loyal to President Salem Robaye Ali. During the fighting, pro-Soviet Liberation Front secretary general Abdel Fattah Ismail calls in Soviet-built MIG's and strafes the palace.

President Robaye Ali and 2 other members of the Liberation Front are tried by a revolutionary court and are executed by a firing squad. Robaye Ali, head of the Presidency Council, was accused of attempting to take complete control of the government.

June 27—Arab diplomatic sources indicate that Prime Minister Ali Nasser Mohammed Hasari, secretary general of the National Liberation Front Abdel Fattah Ismail, and Defense Minister Colonel Ali Antar constitute the ruling triumvirate; Hasari is reportedly titular head of state.

June 29—Abdel Fattah Ismail, secretary general of the ruling 3-party National Front, announces that moderates have been purged.

**SPAIN**

(See *China*)

**TAIWAN**

(See also *Vietnam*)

May 20—Chiang Ching-kuo is inaugurated as President; he appoints Sun Yun-suan as Prime Minister.

**THAILAND**

(See *U.S., Foreign Policy*)

## TURKEY

- June 21—Prime Minister Bulent Ecevit arrives in Moscow for a state visit; he is met at the airport by Soviet Prime Minister Aleksei N. Kosygin and Soviet Foreign Minister Andrei A. Gromyko.  
 June 22—Prime Minister Ecevit meets with Soviet President Leonid I. Brezhnev.  
 June 23—Prime Minister Ecevit and Soviet officials sign a non-aggression treaty.

## U.S.S.R.

(See also *Intl. Arms Control; China; Czechoslovakia; West Germany; Turkey; U.S., Foreign Policy; Zaire*)

- May 8—President Leonid I. Brezhnev returns from Bonn, where he met with German Chancellor Helmut Schmidt.  
 May 18—Following a 4-day trial, Yuri Orlov, a physicist accused of anti-Soviet agitation, is sentenced to 7 years in prison, to be followed by 5 years in exile or in enforced residence.  
 May 31—In Prague during a state visit, President Leonid I. Brezhnev accuses Belgium and France of "cynical interference" in the fighting in Zaire.  
 June 25—In a televised speech in Minsk, Soviet President Brezhnev charges that the administration of U.S. President Jimmy Carter is pursuing "a short-sighted . . . policy" of trying "to play the 'Chinese card' " against the Soviet Union.  
 June 28—*New York Times* reporter Craig Whitney and *Baltimore Sun* reporter Harold Piper are accused in a Moscow court of libeling the Soviet state television.  
 June 29—Five days before a scheduled court hearing, the Soviet press agency Tass says that Whitney and Piper are guilty of libel.  
 According to a CIA report, the Soviet Union will continue to increase its military spending by 4 to 5 percent annually during the 1980's.

## UNITED KINGDOM

### Great Britain

(See also *U.S., Legislation*)

- May 8—The Labor party is defeated on a tax proposal by a 312-304 vote.  
 May 10—In London, it is announced that Princess Margaret and her husband, the Earl of Snowdon, will be divorced.  
 May 15—The House of Commons votes to permit the construction of a nuclear-powered fuel reprocessing plant on the northeast coast.  
 May 25—David Steel, leader of the Liberal party, announces that his party will no longer support the Labor party in Parliament.  
 June 14—Prime Minister James Callaghan's Labor party wins a vote of confidence in the House of Commons by a vote of 287 to 282.

### Northern Ireland

- June 4—A 70-page report by Amnesty International leaked to the press accuses the Ulster police of using brutality against terrorist suspects.

## UNITED STATES

### Administration

- May 3—Speaking at Golden, Colorado, President Jimmy Carter says that he has instructed "the Department of Energy through reprogramming to provide an additional \$100 million for expanded efforts in solar research . . . in the next fiscal year."

- May 5—President Carter ends a 3-day, 4-state western trip.  
 May 12—A statement issued by the White House says that President Jimmy Carter will delay asking for a tax cut.  
 May 15—The Agriculture Department issues an order (to take effect June 15) restricting the use of the preservatives sodium and potassium nitrite in bacon; the preservatives form cancer-inducing nitrosamines when bacon is cooked.  
 May 16—The trustees of the Social Security Trust Fund report that the social security tax increase passed by Congress on December 20, 1977, has restored financial soundness to the system until the year 2030.  
 May 19—Former United States Information Agency official Ronald Humphrey and Vietnamese student David Truong are found guilty in a federal district court of spying for Hanoi.  
 The Postal Service Board of Governors agrees to raise first class mailing costs to 15 cents an ounce effective May 29; costs of other classes of mail will also rise.  
 May 20—The Federal Bureau of Investigation announces the arrest of Soviet U.N. workers Rudolph Chernyayev and Valdik Enger on espionage charges.  
 May 23—Secretary of Labor F. Ray Marshall tells reporters that the administration will channel \$400 million in fiscal 1979 to private employers to train and hire 150,000 jobless workers.  
 June 1—The Civil Aeronautics Board issues a revision of its rules (to take effect September 3), which will require airlines to pay up to \$400 to passengers with confirmed reservations who are "bumped" from their seats because of overbooking.  
 June 2—Director of the 1979 White House Conference on Families Patsy Fleming resigns from her post.  
 June 8—At the White House, President Carter announces a Federal Home Loan Bank Board program designed to encourage savings and loan associations to lend up to \$10 billion to inner city and older neighborhood borrowers.  
 At a White House news conference, President Carter announces an increase in the imported beef quota to help check the rapid increase in beef prices.  
 June 9—President Carter proposes 26 new water projects to Congress and asks that Congress authorize the full \$720-million expenditure for the projects.  
 June 15—White House press secretary Jody Powell discloses that President Carter paid slightly more than \$48,000 in federal income tax in 1977.  
 June 16—Tennessee Valley Authority Chairman S. David Freeman and Assistant Secretary of the Interior Robert Herbst issue a statement in Washington, D.C., suggesting "that an alternative [to the Tellico Dam project on the Little Tennessee River] may be fashioned that can provide benefits . . . superior to those which would have been provided" had the dam been completed. (See also *Supreme Court*.)  
 June 17—Secretary of Health, Education and Welfare Joseph Califano, Jr., announces that the White House Conference on Families has been postponed from December, 1979, to 1981.  
 June 19—President Carter submits plans to Congress calling for revisions in civil defense under a proposed new agency, the Federal Emergency Management Agency.  
 June 21—Officials of the Labor Department's Occupational Safety and Health Administration (OSHA) estimate that the failure of the federal agencies to comply with OSHA rules increased the costs of federal worker sickness and injury by \$5 billion last year.  
 In a message to Congress, President Carter warns that he may veto legislation proposed in Congress that pro-

vides for legislative vetoes of arms sales, departmental spending, and other executive actions.

June 29—President Carter issues an executive order revising the procedures under which government documents are classified.

June 30—The Nuclear Regulatory Commission, by a divided vote, orders suspension of construction of the Seabrook, New Hampshire, nuclear power plant.

### Civil Rights

June 9—Spencer Kimball, president of the 4.2-million member Church of Jesus Christ of Latter-day Saints (Mormons), says that a "revelation has confirmed that the long promised day has come when every faithful, worthy man in the church may receive the holy priesthood." Previously, black Mormons had been denied this status.

June 12—With 2 justices dissenting, the Supreme Court denies a request for a temporary stay against a demonstration by American Nazis in Skokie, Ill.

June 22—The National Socialist party of America (Nazi) calls off its planned June 25 march in Skokie.

### Economy

May 4—The Labor Department reports that wholesale prices rose 1.3 percent in April; this is the largest gain in over 3 years.

May 5—The Labor Department reports that the jobless rate dropped to 6 percent in April, the lowest figure in over 3.5 years.

May 11—The Federal Reserve raises the discount rate on loans to banks from 6.5 percent to 7 percent.

May 26—The Commerce Department reports a \$2.9-billion deficit in the balance of trade in April.

June 2—The Labor Department reports that the unemployment rate for May was 6.1 percent, up slightly from the previous month; the labor force rose above 100 million for the 1st time.

June 6—Californians vote overwhelmingly to pass Proposition 13, a voter initiative that orders a cut in property taxes by 60 percent beginning July 1; the measure will mean the loss of \$7 billion in property tax revenue for the state in the fiscal year beginning July 1, 1978.

June 27—The Commerce Department reports that the nation's foreign trade deficit was \$2.24 billion in May.

June 30—The Labor Department reports that the consumer price index rose 0.9 percent in May.

### Foreign Policy

(See also *Intl. NATO; China; East Germany; Laos*)

May 2—Vice President Walter Mondale arrives in the Philippines on the start of a 5-nation trip.

May 3—President Carter confers with Japan's Prime Minister Takeo Fukuda in Washington, D.C.

Vice President Mondale and Philippine President Ferdinand Marcos sign 4 new aid agreements totaling about \$41 million in U.S. aid to the Philippines.

May 4—In Bangkok, Thailand, Vice President Mondale says that the U.S. is willing to take the lead in resettling some 100,000 Indochinese refugees.

May 5—Speaking at a town meeting in Spokane, Washington, President Carter says that he sent several private warnings to Soviet President Leonid Brezhnev about Soviet and Cuban involvement in parts of Africa.

May 10—Vice President Mondale arrives in Honolulu, concluding a 12-day tour of Southeast Asia and the Pacific.

May 13—In a May 12 interview released today, President Jimmy Carter says that Cuba's President "Castro is acting contrary to peaceful settlement of disputes that are inevitable in Africa . . ." and that he acts "under the domination of the Soviets."

May 15—The Senate approves President Carter's Middle East arms proposal. (See also *Legislation*.)

May 19—The White House reveals that 18 U.S. Air Force C-141 transports are participating in the Belgian-French airlift in Zaire.

May 23—White House national security adviser Zbigniew Brzezinski arrives in Tokyo to talk to Japanese Prime Minister Takeo Fukuda after visiting Peking; it is reported that he has told Fukuda that the Chinese want a peace treaty with Japan.

May 25—At a news conference in Chicago, the President says he is opposed to further congressional restrictions on his power to provide aid to friendly and nonaligned nations; he charges Cuba knew of the Katangan rebels' plan to invade Zaire and did not try to stop the invasion.

May 27—In Washington, D.C., administration officials reveal that Brzezinski disclosed details about U.S. security goals and Soviet-American strategic arms talks to Chinese officials; the talks are described as the "fullest and most extensive consultations" with Peking since China and the U.S. resumed contact in 1971.

May 30—Opening a 2-day NATO meeting in Washington, D.C., President Carter scores the Soviet military concentration in Europe and says that the West "cannot be indifferent" to alleged Soviet and Cuban interference in Africa.

June 1—The State Department discloses that on May 23 "electronic devices of an intelligence gathering nature" were found in the American Embassy in Moscow; it has formally protested to the Soviet Foreign Ministry.

June 2—At a White House press conference, President Carter says he is committed to reaching an arms pact with the Soviet Union and that U.S. policy remains "to proceed aggressively with SALT discussions, to conclude a treaty as early as possible . . ."

President Carter and CIA director Admiral Stansfield Turner brief congressional leaders on evidence that supports the administration's claim that Cuba was heavily involved with the Katangan insurgents who invaded Shaba province in southern Zaire last month.

June 5—After a failure to agree on fish management in Atlantic and Pacific waters, the U.S. and Canada begin to exclude each other's fishing boats from their respective waters.

June 7—In a commencement address to U.S. Naval Academy cadets, President Carter strongly attacks the Soviet Union for its "continuing aggressive struggle for political advantage and increased influence."

June 8—Washington, D.C., sources report that the U.S., reversing an earlier decision, will sell China airborne geological survey equipment with a military potential.

June 14—It is reported in Washington, D.C., that Soviet Foreign Minister Andrei Gromyko warned U.S. President Carter two weeks ago that unless 2 Soviet U.N. employees who are being held by U.S. authorities on espionage charges are released, the Soviets will take action against U.S. citizens in Moscow.

June 15—In a joint communiqué after 2 days of meetings in Washington, D.C., President Jimmy Carter and Indian Prime Minister Morarji Desai say that there has been "significant improvement" in U.S.-Indian relations in the last year.

June 16—In a short ceremony in Panama City, Panama, President Jimmy Carter and Panamanian leader



Brigadier General Omar Torrijos Herrera sign 5 documents that formally conclude the Canal treaties.

June 17—Speaking at Fort Clayton, the Canal Zone army base, to Canal Zone workers, President Carter says that the rights of the Americans in the Zone will be respected.

June 21—President Jimmy Carter addresses the foreign ministers of the Organization of American States and says that his administration will continue to emphasize the importance of human rights.

June 23—State Department spokesman John Trattner says that the U.S. is recalling Ambassador to Chile George Landau for "consultations."

June 26—Speaking at a nationally televised news conference, President Carter says that "I have a deep belief that the underlying relationship between ourselves and the Soviets is stable and that Mr. Brezhnev, along with myself, wants peace and wants to have a better friendship." He also says our commitment to "pursuing a comprehensive . . . peace agreement in the Middle East is constant . . ."

Soviet U.N. employees Rudolph Chernyayev and Valdik Enger, arrested in New Jersey on espionage charges, are released to the custody of Soviet Ambassador Anatoly Dobrynin; 18 hours later, American F. Jay Crawford, arrested in Moscow on currency violation charges, is released to the custody of U.S. Ambassador Malcolm Toon.

June 27—The White House announces that the U.S. will send a 14-member delegation of scientists to Peking July 6-10 for talks on science and technology.

June 29—Commenting on the Soviet libel charge against 2 reporters, State Department spokesman Hodding Carter 3d says, "We hope the Soviet authorities will reflect very carefully on the broader implications of this issue."

Vice President Mondale begins a 4-day trip to Israel and Egypt.

June 30—State Department officials report that a plan to sell 60 F-4 fighter-bombers to Taiwan has been dropped.

### Labor and Industry

May 10—The AFL-CIO executive council refuses to accept President Carter's proposal for voluntary wage ceilings; George Meany, president of the council, says that the emphasis of an anti-inflation program should be placed on curtailing price increases, not on wages.

### Legislation

May 3—After threatening to veto it, the President signs a bill authorizing \$3 million for 2 White House conferences on the humanities and on the arts. Chief sponsor of the bill was John Brademas (Ind.), House Democratic whip.

May 9—Benjamin R. Civilette is confirmed by the Senate as U.S. Deputy Attorney General.

May 15—In a 54-44 vote, the Senate approves the administration's plan to sell war jets to Saudi Arabia, Egypt and Israel. The sale would have been blocked if both houses of Congress adopted resolutions opposing it.

May 17—A tentative budget of \$498.8 billion, already approved by the Senate, is approved by the House. The budget target is almost \$1.4 billion lower than the administration's proposed budget.

May 24—After 219 days of discussion, congressional conferees on energy agree on natural gas pricing guidelines.

May 26—The Senate Foreign Relations Committee asks the administration for evidence that Cuba has been a participant in the recent invasion of Zaire by rebels based in Angola.

June 22—By a 273-125 vote, the House cuts off \$56 million

in food aid to South Korea because of South Korea's refusal to permit former South Korean Ambassador to the U.S. Kim Dong Jo to testify on the alleged South Korean bribery of U.S. legislators; the vote comes on an amendment to an agricultural appropriations bill.

June 27—By a 82-5 vote, the Senate ratifies a modified tax treaty with Britain.

In a major defeat for the administration's energy program, the Senate refuses to allow the President to raise import fees on oil.

### Military

June 21—The cruise missile is flown publicly for the first time at White Sands Missile Range, New Mexico.

June 22—Officials of the Defense Department say that Defense Secretary Harold Brown has tentatively approved a plan to enable the U.S. to convert its nuclear warheads to neutron weapons if the President orders the conversion.

### Political Scandal

May 8—In a document filed with the Securities and Exchange Commission, Textron Inc. (the parent corporation of Bell Helicopter) discloses that a Bell memorandum about a \$300,000 bribe to a Ghanaian official (to induce Ghana to buy helicopters from Bell) was destroyed the day after G. William Miller was asked about the transaction at Senate hearings on his appointment as chairman of the Federal Reserve Board. Miller is Textron's former chairman.

May 19—Naturalized American citizen Hancho C. Kim is sentenced to 6 years in prison for his role in the Korean influence-buying scandal.

May 22—Congressional sources say that as many as 10 current congressmen may have received bribe money from former Korean Ambassador Kim Dong Jo.

### Supreme Court

May 1—The Supreme Court decides unanimously that a state may not impose criminal sanctions on a newspaper that carries accurate reports of confidential disciplinary proceedings against a judge. *The Landmark Communications Company v. Virginia* case involved the Virginia constitution.

The Court rules 6 to 3 that because of the constitutional guarantees of due process of law a municipal utility may not cut off customer service without providing an opportunity for the customer to present his complaint to company representatives. City-owned plants can no longer cut off service at will when bills are overdue, because "utility service is a necessity of modern life."

May 15—Ruling unanimously, the Court decides that the Securities and Exchange Commission cannot halt trading in a stock for more than 10 days without notice, a hearing, or any kind of explanation. The SEC has been tacking on a series of 10-day trading suspensions against stocks when fraud or manipulation are suspected.

May 23—The Court rules that juries deciding whether community standards are offended by allegedly obscene magazines and films may not take into account the possible reactions of children. The case, involving a California man, is sent back for a new trial.

The Court rules 5 to 3 that the Occupational Safety and Health Administration cannot make spot searches of employers' premises without a search warrant.

May 30—The Court rules unanimously that a state may discipline a lawyer who personally solicits clients for his



own private gain; however, the Court rules 7 to 1 that a lawyer for the American Civil Liberties Union was acting properly when he wrote a potential client in South Carolina inviting her to join in a suit against a doctor who had sterilized her and other welfare mothers; this was regarded by the Court as "an offer of free assistance."

May 31—By a 5-3 vote, the Supreme Court reverses decisions by 2 lower courts and rules that police do not have to notify newspapers and/or persons not involved in crime in any way that a court-approved search is to be undertaken nor do such newspapers or persons have the right to contest such a search in court.

June 6—By a 7-2 majority, the Supreme Court rules that municipalities may be open to law suits if their official policies have deprived their residents of their civil rights.

June 14—In a 5-4 vote, the Court reverses a previous decision and says that "a criminal defendant who at his trial wins dismissal of charges against him 'on grounds unrelated to factual guilt or innocence, can be tried by the government a second time.'"

June 15—By a 6-3 vote, the Court upholds an injunction granted by the U.S. Court of Appeals for the Sixth Circuit that barred completion of the Tellico Dam on the Little Tennessee River because the survival of the 3-inch snail darter fish would be endangered by the dam, in violation of the Endangered Species Act.

June 26—By a 6-3 vote, the Court upholds the constitutionality of the Price-Anderson Act that limits the liability of private nuclear power companies in case of a nuclear accident.

June 28—In the case of the *Regents of the University of California v. Bakke*, the Court rules 5 to 4 that Allan P. Bakke must be admitted to the California Medical College at Davis, because the school's use of an explicit racial classification in its affirmative action program violates Title VI of the Civil Rights Act of 1964, which forbids discrimination based on race at any educational institution that accepts federal funds. In a 2d 5-4 opinion, the Court rules that a flexible affirmative action program in which race is only one of the considerations is legitimate and constitutional. This 150-page ruling that includes 6 separate opinions is the Court's 1st ruling on "reverse discrimination."

June 29—In a 5-4 decision, the Court rules that federal officials with discretionary power are entitled only to qualified, not full, immunity from damage suits.

In a 6-3 decision the Court rules that the issue of double jeopardy is not involved if a juvenile case is heard first by a court-assigned master and then by a judge.

## UPPER VOLTA

May 29—The Interior Ministry announces that General Sangoule Lamizana was recently elected President. Lamizana has ruled the country since 1966.

## URUGUAY

(See *Intl. OAS*)

## VIETNAM

(See also *China*)

May 17—It is reported that fighting has broken out again along the Cambodian-Vietnamese border.

June 17—It is reported in Peking that China's ambassador to Vietnam has returned to China because of ill health.

June 19—Hanoi radio reports that the Chinese government has ordered Vietnam to close her consulates in 3 Chinese cities.

June 20—In Taipei, the Taiwan government announces its decision to speed up the withdrawal from Vietnam of all ethnic Chinese who have relatives in Taiwan.

The Vietnamese government accuses China of supporting Cambodia in the war with Vietnam and of following a "disastrous policy" in relations with Vietnam.

June 27—Hanoi radio reports that heavy fighting continues along the Cambodian-Vietnam border; during the last week, Vietnamese troops have reportedly killed about 160 Cambodian soldiers in 2 battles.

## YEMEN

June 24—In Beirut, President Ahmed Hussein al-Ghashmi is killed when a bomb explodes as an envoy from Southern Yemen opens a diplomatic bag containing a letter from Southern Yemen's President Salem Robaye Ali.

June 25—The Southern Yemen government denies any involvement in the assassination of President Ghashmi.

## YUGOSLAVIA

May 16—Fadilj Hodza is elected Vice President of the Collective Presidency; he is the first in line to succeed President Tito; Dragoslav Markovic is elected president of Parliament; he succeeds Kiro Gligorov.

June 20—President Tito addresses the opening session of the 11th congress of the Yugoslav Communist party.

## ZAIRE

May 14—In Kinshasa, according to the official press agency, President Mobutu Sese Seko claims that on May 11 4,000 former Katangan rebels from Angola invaded Shaba province and the copper-mining town of Kolwezi. He claims the rebels are supported by Cuba, Algeria and Libya.

May 16—The U.S. Defense Department places the 82d Airborne Division and the Military Airlift Command on alert for the possible evacuation of U.S. citizens in Zaire.

May 18—Nearly 1,000 Belgian paratroopers leave for Zaire to evacuate more than 2,500 Europeans and Americans.

May 19—In Paris, it is reported that 400 French paratroopers have been airlifted into Kolwezi.

May 20—Belgian and French troops take control of Kolwezi.

May 23—The European death toll is reported at about 200.

May 24—Belgian Prime Minister Leo Tindemans calls for the creation of an all-African peacekeeping force to protect the copper mines in Shaba province.

May 25—French paratroopers begin to withdraw from Kolwezi to Lubumbashi, the capital of Shaba province. Zairian and Moroccan forces will maintain order.

May 29—At the insistence of European mining industry personnel, some French and Belgian troops remain in southern Shaba to insure the safety of the Europeans.

June 2—In Tangier, Moroccan King Hassan II announces that he will send Moroccan troops to Zaire "to be at the disposal of the Organization of African Unity along with other African forces."

June 3—In Kinshasa, China's Foreign Minister Huang Hua arrives for talks with President Mobutu.

June 4—In Paris, representatives of 5 Western nations begin talks on the Soviet involvement in Africa.

U.S. transport planes begin airlifting Moroccan soldiers from Morocco to Zaire.

June 6—Representatives of the five Western nations meeting in Paris (France, Belgium, West Germany, the U.S., and Great Britain) agree to provide short-term military and economic assistance to Zaire.

June 7—In Brussels, Belgian Prime Minister Leo Tindemans says Belgian troops will withdraw as soon as they are replaced by African soldiers.

June 9—It is announced in Kinshasa that France and Belgium will train an elite force of Zairian troops to defend Shaba province.

June 10—In Washington, D.C., it is reported that Cuban Prime Minister Fidel Castro informed the U.S. government on May 17 that he had learned of the impending invasion by insurgents into Shaba province in April and that he had tried to stop it. On May 25, President Carter accused Cuba of having previous knowledge of the invasion and of doing nothing to prevent it.

June 11—10 members of Zaire's Information Department arrive in Peking.

June 13—In Brussels, on the first day of an 11-nation conference on Zaire, President Mobutu agrees to permit the International Monetary Fund to assume virtual control of the country's economy as part of a \$1-billion plan to bolster the economy.

June 16—The remaining French legionnaires leave Shaba province and return to their base in Corsica.

June 18—It is revealed in Kinshasa that China has sent several military advisers to help train Zaire's navy.

### ZAMBIA

May 18—President Kenneth D. Kaunda meets in Washington, D.C., with U.S. President Jimmy Carter.

## NUCLEAR POWER

(Continued from page 38)

adoption would lead to the wide distribution of near-bomb capabilities.

The breeder has been considered imminent for so long that it is often forgotten that it is not yet commercially developed. What its costs will turn out to be are highly uncertain; it may be a winner; more likely, it will be uneconomical.<sup>12</sup> Time and the expenditure of a great deal more money for research and development will tell. Governments might, of course, buy or subsidize the purchase of breeders, even if the breeders are unable to produce a kilowatt-hour of electricity at a competitive cost. But it would be an illusion if a government thinks that it will soon be going to achieve a high degree of

<sup>12</sup>The economic arguments that refute such presentations are made persuasively by Brian Chow, "The Economic Issues of the Fast Breeder Reactor Program," *Science*, February, 1977, pp. 551-555.

<sup>13</sup>Harold A. Feiveson and Theodore B. Taylor, "Security Implications of Alternative Fission Futures," *The Bulletin of the Atomic Scientists*, December, 1976, pp. 14-18, 46-48.

<sup>14</sup>It is noteworthy, for example, that the apparent nuclear test site in South Africa's Kalahari Desert was brought to world attention by national (U.S.S.R.) means of verification, not by international inspectors. The IAEA system might well have failed to give adequate notice. It is still in doubt whether the "critical time" criteria were met, i.e., whether South Africa has nuclear weapons today.

<sup>15</sup>Luther Carter, "Radioactive Wastes: Some Urgent Unfinished Business," *Science*, February 18, 1977, pp. 661-666, 704; Bernard L. Cohen, "The Disposal of Radioactive Wastes from Fission Reactors," *Scientific American*, June, 1977, pp. 21-31.

energy independence using breeders. For example, on one projection, even if the Federal Republic of Germany (with its massive financial and technical resources) were to move substantially into a plutonium economy by using the breeder, its need for other energy sources would be reduced by only about 10 percent by 2020. Achieving energy autarchy is difficult.

Fortunately for the security and safety of the world, there are alternatives. A partial list includes developing and improving reactors that do not depend on the wide circulation of nuclear explosive material;<sup>13</sup> these technical alternatives need more vigorous exploration. At least as important is a change in the international rules for the use of nuclear energy. New rules should make it much more difficult for countries—and terrorists—to procure explosive materials. Agreement is needed that non-nuclear weapons states should not have ready access to nuclear explosive materials. In short, there should be an increase in the "critical time," the indispensable minimum time required for a government (or terrorist or quasi-government group) to move from a legal status to the possession of nuclear explosives.<sup>14</sup> In addition, international arrangements must be made for the removal and storage of spent fuel in safe places; a variety of (safe) schemes must be implemented for the production of low enriched uranium instead of allowing a large number of countries to engage in do-it-yourself enrichment. Major national and international efforts are under way to meet these requirements; the fruits of this work are being brought together in the Nuclear Power Alternative Systems Assessment Program (NASAP) and the International Nuclear Fuel Cycle Evaluation (INFCE) programs. Still other measures are needed to provide nations—or at least some of them—with more adequate non-nuclear defense and with nuclear guarantees to reduce their incentives to procure nuclear bombs. And, as observed above, the IAEA safeguard system can stand a good deal of improvement.

There are other matters of grave importance concerning nuclear power. There has been no discussion about the safety of nuclear reactors, and little has been said about the prospects for the safe, permanent disposition of nuclear wastes, but these problems are also important. There has been wide discussion of safety; public concern on this issue and organized action have produced a generally useful if at times excessive caution with regard to nuclear power development. The permanent disposition of nuclear wastes has not been given adequate attention in the past. There is still much room for argument as to how to handle the problem technically and an even greater difficulty in making that solution politically palatable.<sup>15</sup> However, these issues will probably be overshadowed, serious as they are, in the years ahead by the proliferation concerns that have been discussed here—if plutonium is allowed to circulate legally throughout the world.

# U.S. Energy Resources and Needs, 1950-1990

( -- 1975    - - - 1976    — 1977 )

NOV 16 '79

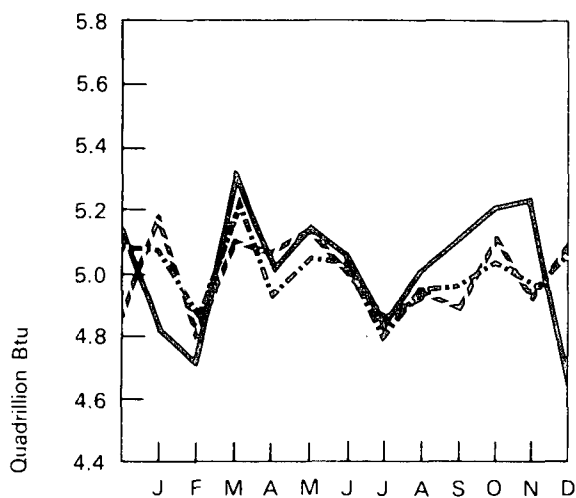
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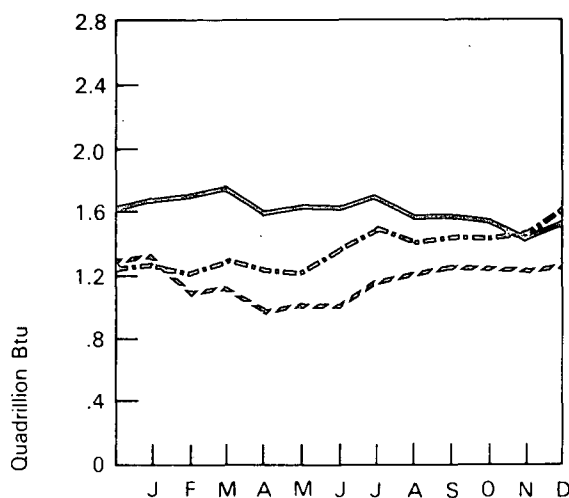
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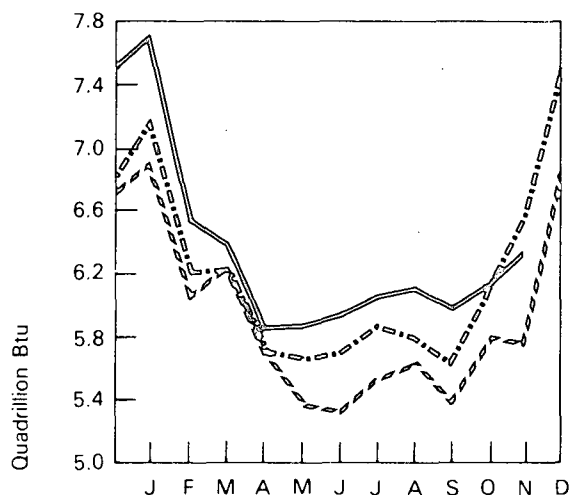
## Domestic Production of Energy



## Imports of Fossil Fuels

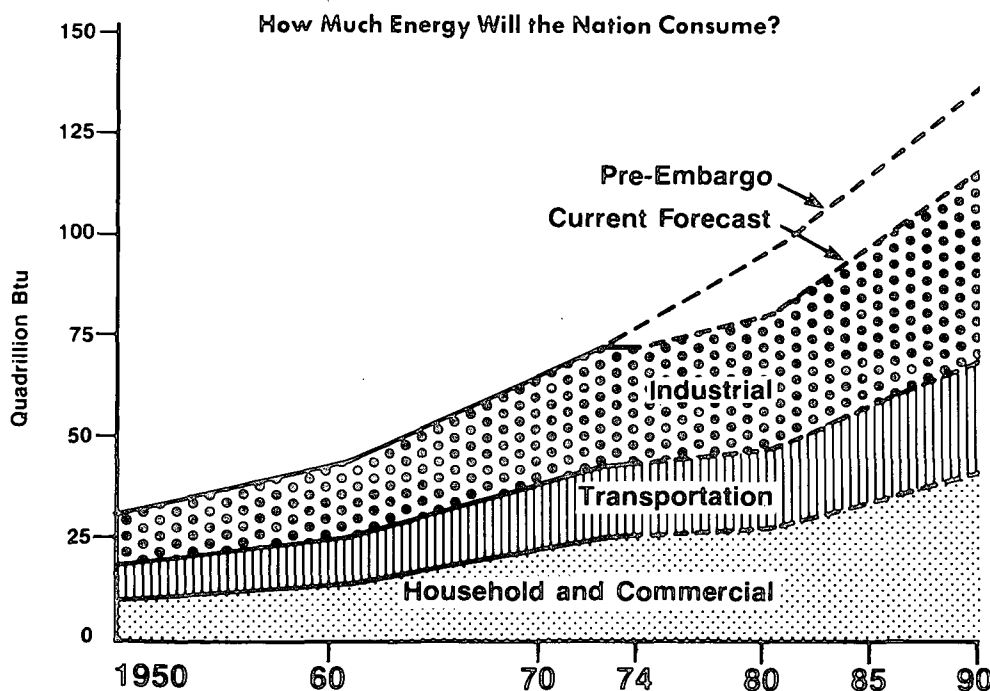


## Domestic Consumption of Energy



		Domestic Production of Energy	Imports of Fossil Fuels	Domestic Consumption of Energy
1972	TOTAL	62.937	11.563	71.895
1973	TOTAL	62.373	14.519	74.551
1974	TOTAL	61.138	14.114	72.601
1975	TOTAL	60.134	13.935	70.557
1976	TOTAL	60.206	16.617	74.318
1977	TOTAL	60.175 (12 months)	19.539 (12 months)	68.818 (11 months)

Source: Energy Information Administration (EIA) calculations



Source: National Energy Outlook 1976, Federal Energy Administration

ELECTRONIC REPRODUCTION PROHIBITED

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